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INSTRUMENTS

INDUSTRIAL — SCIENTIFIC

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Devoted to Measurement and Control Problems

Vol. 2. No. 8. Pittsburgh, Pa. August, 1929

IN THIS ISSUE

Saving Gasoline by Accurate Carburetor Adjustment

J. T. NICHOLS

Non-Volatile Content

H. L. HAZELTINE

New Instruments.

- Automatic Flow Control at 1300 lb. Pressure and 600° F.
- Portable Instruments
- New Constant Temperature Equipment
- Arc Welding Plays Important Role in 1929 Lightning Studies
- New Apparatus for Softening Point Determinations
- The Model 36 Federal Roundness Gauge
- New Amplifying Comparator
- New Manometer is Combined Flow Meter and Pressure Indicator
- New Stop Watches
- Distance Reading Gauge
- A Radio Set Analyzer for Testing Screen Grid Tubes
- A Radio Set Analyzer that Provides Simultaneous Readings
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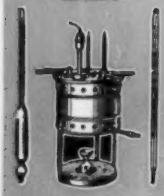

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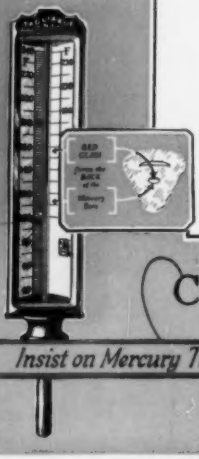

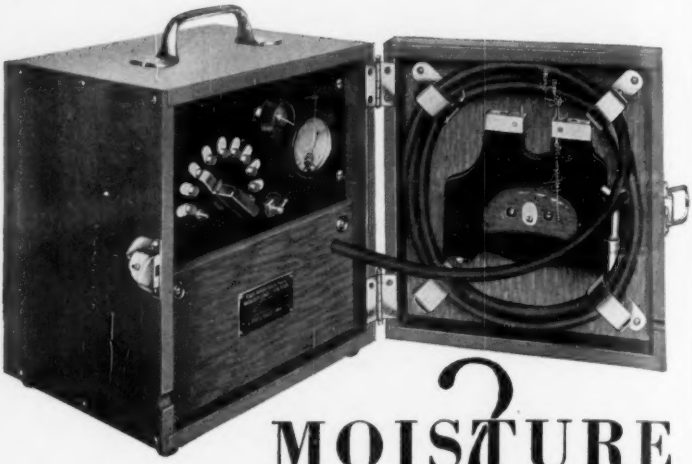

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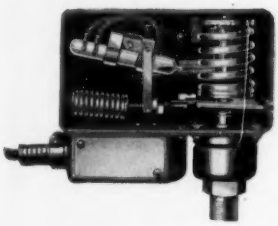

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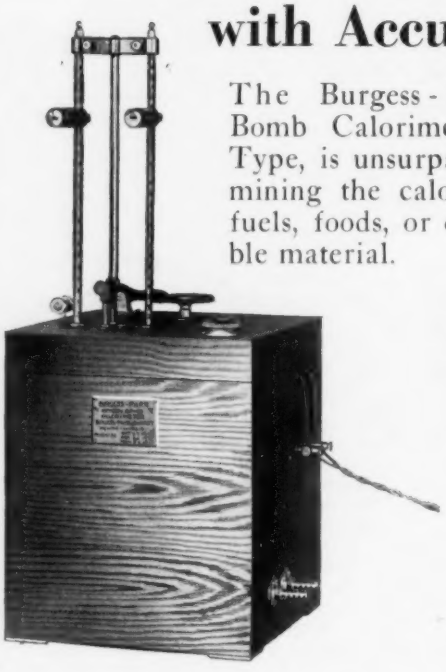

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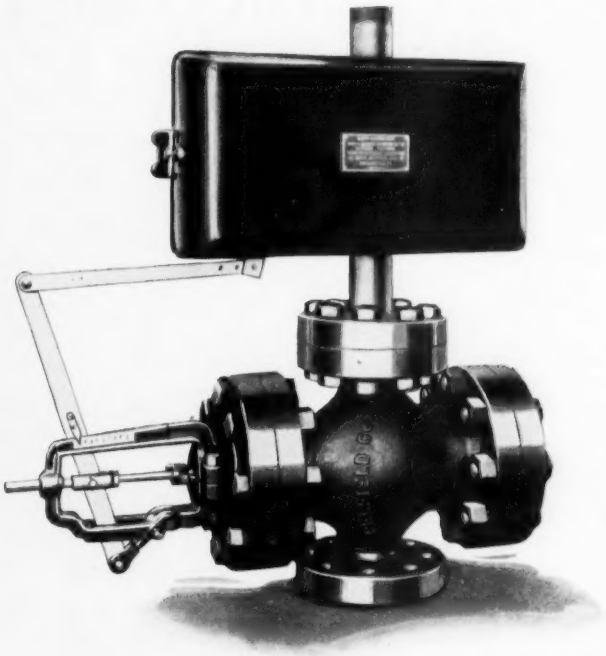

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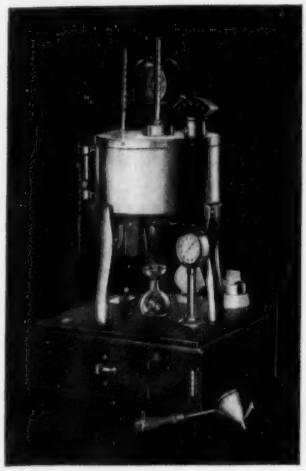

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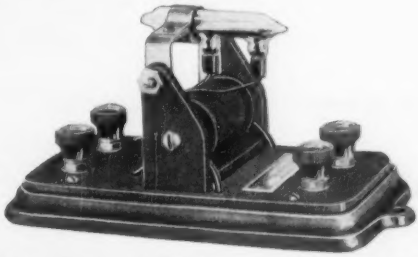

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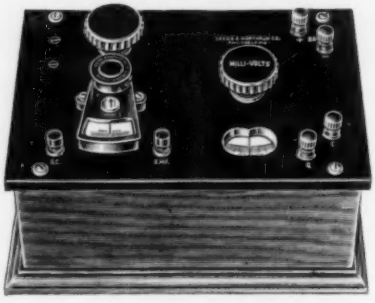

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TABLE OF CONTENTS

VOLUME 2 AUGUST, 1929 NUMBER 8

PAGE

To Our Readers 263

Saving Gasoline by Accurate Carburetor Adjustment—J. T. Nichols 265

Non-Volatile Content—H. L. Hazeltine 269

New Instruments:

- Automatic Flow Control at 1300 lb. Pressure and 600° F. 273
- Portable Instruments 274
- New Constant Temperature Equipment 275
- Arc Welding Plays Important Role in 1929 Lightning Studies 276
- New Apparatus for Softening Point Determinations 277
- The Model 36 Federal Roundness Gauge 279
- New Amplifying Comparator 281
- New Manometer is Combined Flow Meter and Pressure Indicator 283
- New Stop Watches 284
- Distance Reading Gauge 285
- A Radia Set Analyzer for Testing Screen Grid Tubes 287
- A Radio Set Analyzer that Provides Simultaneous Readings 288
- A Portable Direct Reading Tube Tester 290
- The Midworth Distant Repeater 291
- The Groundometer 293
- Soil Pressure Cells 295

Catalogue Library 13
Current Literature Review 16
Instruments' Book Shelf 272
Buyers' Guide 22
Advertisers' Index 28
Index Card Section 30

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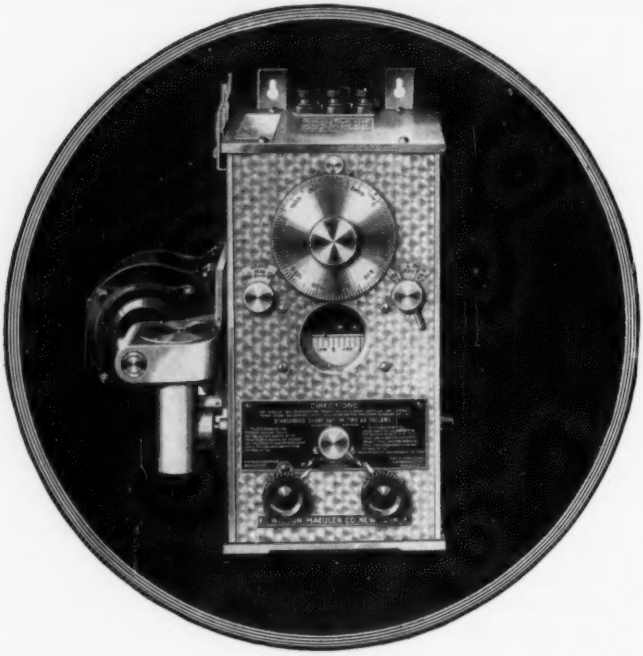

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INDUSTRIAL — SCIENTIFIC

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Vol. 2, No. 8 AUGUST, 1929 Pittsburgh, Pa.

To Our Readers

THE New Instrument Section of this issue should arouse considerable interest, due to the large number of new instruments which are covered therein.

In the New Instrument Section of INSTRUMENTS, an attempt is made to cover all new developments in instruments and devices for measurement, inspection and control.

It is not necessary that the device or instrument operate on a wholly new principle, never before used. It covers all devices made by a manufacturer, never made by him before; or improvements and changes in the instruments and devices manufactured by him.

From an editorial standpoint the articles appearing in the New Instrument Section are just as important as any other information contained in the journal.

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The articles in the New Instrument Section, covering new developments, should be confined to about one thousand words including illustrations. The reason for this is that all articles in INSTRUMENTS start on the right-hand page, and as each page has approximately five hundred words, the articles will end on the bottom of the left hand page.

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Saving Gasoline by Accurate Carburetor Adjustment

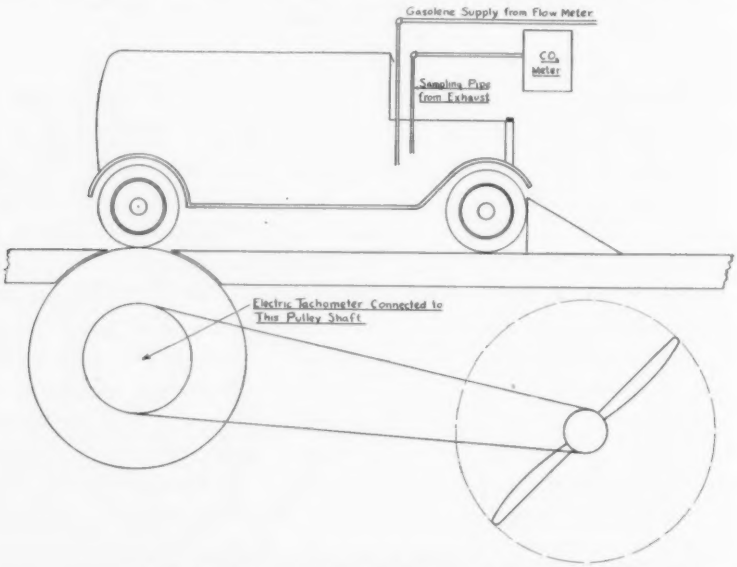
J. T. Nichols

ONE pound of ordinary gasolene requires about 15 pounds of air for complete combustion. Maximum efficiency of combustion is obtained with about 16 pounds of air and, when burned in the average automobile or truck engine, maximum power may be obtained with any amount between 10 and 14 pounds. Most drivers are primarily interested in getting the maximum performance possible and the economy of operation is only of secondary importance. Consequently if the carburetor is adjusted for an air-fuel ratio of about 10:1 the average driver will be quite well satisfied even through it is true that he could obtain the same performance and much greater economy by using a mixture of about 14:1. Since there is now no commercial apparatus for measuring the air-fuel ratio while adjusting a motor vehicle carburetor it is natural that mechanics should err an the side of the richer mixtures and this has been found to be the case by A. C. Fieldner and his associates in their investigation of vehicular tunnel ventilation.[1]

The writer recently tested ten taxicabs picked at random from a large fleet. These cabs were equipped with carburetors of the fixed jet type. Only a few weeks before smaller jets had been installed on the entire fleet in the interest of greater gasolene economy and it was the service department's belief that no further saving could be affected. Only one of the ten cabs chosen proved to have an economical adjustment, and by the use of exhaust gas analyses, it was possible to make savings of more than 30 per cent on four of them. The average saving for this small fleet of ten cabs was 24.5 per cent. These adjustments were made on the road, using a portable apparatus for the measurement of CO_2 in the exhaust gases. The effect of the adjustment on the engine's power was determined by timing the car between two reference points on a convenient hill and the gasolene consumption was measured over a standard course before and after the adjustment. Each adjustment required about two hours time for two men besides the driver. At this rate the adjustment of a large fleet would be an endless task and it is probably because of the large amount of work involved that this opportunity to save a substantial amount of gasolene has been neglected by fleet owners.

(1) Gasolene Losses Due to Incomplete Combustion in Motor Vehicles, by A. C. Fieldner, A. A. Straub, and G. W. Jones. U. S. Bureau of Mines, Reports of Investigations, Serial No. 2225. (1921).

In order to realize this most attractive saving, however, it is only necessary to design an apparatus by means of which it shall be possible to make an accurate carburetor adjustment in the shop in a few minutes time. And this has been done. The accompanying diagram shows an


Gasolene Supply from Flow Meter
CO_2 Meter
Sampling Pipe from Exhaust
Electric Tachometer Connected to This Pulley Shaft

arrangement whereby the machine whose carburetor is to be adjusted is made to drive an airplane propeller. An automatic CO_2 meter is connected to the exhaust pipe. Gasolene is supplied to the engine through a simple flow meter which indicates the consumption in gallons per hour. A tachometer shows the speed at which the car would be traveling on the road, in miles per hour. The cars to be tested must be provided with convenient attachments for the CO_2 meter and the gasolene supply. By the use of this equipment an accurate adjustment should be obtained in 20 minutes or less and an average saving of more than 20 percent would result.

The use of the airplane propeller to load the engine makes it possible to simulate the load imposed by driving at various speeds without the necessity of adjusting brakes or rheostats and is the chief factor in making it possible for one man to operate the test equipment unaided. It is only necessary to put the machine to be adjusted on the propeller-dynamometer, connect the CO_2 meter and the gasolene supply, and adjust the needle valve till the CO_2 content of the exhaust gases is as high as possible without a reduction of speed as shown by the tachometer. Ordinarily it will only be necessary to do this at one speed. The idling adjustment may then be made in the usual way. The saving may be determined by noting the indication of the flow meter before and after adjustment.

A fleet of only 200 cabs will use about one million gallons of gasolene per year. At an average price of 15 cents per gallon this will cost $150,000. Accurate carburetor adjustment will save more than 20 percent of this or more than $30,000 a year. A fleet owner with a gasolene bill of only $10,000 per year can hardly afford to neglect such an opportunity for saving. The general adoption of such an apparatus will tend to conserve our supply of petroleum and will thus delay the advance of gasolene prices which must accompany its depletion. The annual gasolene consumption in the United States is about 10 billion gallons. At an average retail price of 20 cents per gallon accurate carburetor adjustment would save the American motorists about 400 million dollars a year.

ACKNOWLEDGMENT

The writer is indebted to Mr. J. H. Holden for his splendid cooperation in carrying out the tests on these taxicabs.

———— :: ————

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NOTE:—Instruments' Book Shelf is prepared to supply any book or periodical.

GENERAL

A HANDBOOK OF PHYSICS MEASUREMENTS. Erwin S. Ferry and others. Vol. 1. Fundamental Measurements, properties of matter and optics. 1926. 288 pages, $2.50. Vol. II. Vibratory Motion, Sound, Heat, Electricity and Magnetism. 1926. Cloth, 235 pages, $2.00.
MANUAL OF PHYSICAL MEASUREMENTS. A. Zeleny and H. Erikson. 1923. Cloth, 286 pages, $2.25.
THE THEORY OF MEASUREMENT. A Palmer. 1912. Cloth, 248 pages, $3.00.

TEMPERATURE MEASUREMENT

PRACTICAL PYROMETRY. Erwin S. Ferry and Others. 1917. Cloth, 147 pages, $1.50.
METHODS OF MEASURING TEMPERATURE. Ezer Griffiths. 1925. Cloth, 203 pages, $5.00.
PYROMETRY. W. Wood and J. Cork. 1927. Cloth, 207 pages, $3.00.
ELEKTRISCHE TEMPERATUR-MESSGERAETE. G. Keinath. 1923. Cloth, 275 pages, $4.00.
ANLEITUNG ZU GENAUEN TECHNISCHEN TEMPERATUREMESSUNGEN. O. Knoblauch and K. Hencky. 1926. Cloth, 174 pages, $4.00.

SURVEYING

TEXTBOOK ON SURVEYING AND LEVELING. Threlfall. 1920. Cloth, 663 pages, $7.00.
SURVEYING MANUAL. H. Ives, 1914. Cloth, 296 pages, $2.25.
TECHNIC OF SURVEYING INSTRUMENTS & METHODS. W. Webb & J. Fish. 1917. Cloth, 319 pages, $2.50.
MANUAL OF UNDERGROUND SURVEYING. L. W. Trumbull. 1910. Cloth, 251 pages, $3.00.
SURVEYING MANUAL. W. Pence and M. Ketchum. 1915. Cloth, 388 pages, $2.50.
SURVEYOR'S HANDBOOK. T. Taylor. 1908. Cloth. 328 pages, $2.50.
GEODETIC SURVEYING AND ADJUSTMENT OF OBSERVATIONS. E. Ingram. 1911. Cloth, 389 pages, $3.50.
THE PLANE TABLE AND ITS USE IN SURVEYING. W. Lovell. 1908. Cloth, 50 pages, $1.00.
THE PRINCIPLES AND PRACTICE OF SURVEYING. C. B. Breed & G. L. Hosmer. Vol. I. Elementary Surveying. 1908. Flexible, 592 pages, $4.00. Vol. II. Higher Surveying, 1912. Flexible, 489 pages, $3.50.
GEODETIC SURVEYING. E. R. Cary. 1916. Cloth, 279 pages, $2.50.
THE EFFECTS OF ERRORS IN SURVEYING. Henry Briggs. 1912. Cloth, 179 pages, $4.00.
TREATISE ON MINE SURVEYING. Bennett Brough and H. Dean. 1926. Cloth, 473 pages, $5.50.
THE ELEMENTS OF ASTRONOMY FOR SURVEYORS. R. Chapman, 1922. Cloth, 251 pages, $2.75.
FIELD METHODS IN PETROLEUM GEOLOGY. G. Cox, C. Drake and G. Muilenburg. 1921. Cloth, 305 pages, $4.00.

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Non-Volatile Content

H. L. Hazeltine *

IN the selection of suitable varnishes and paints, probably one of the most mysterious elements to the scientific mind is the variation of prices offered on materials for which almost identical claims are made. Naturally it will be found in the course of time that in some cases representations are made that are not substantiated in the material offered, but eliminating false guarantees, it is still necessary to have definite standards of value in order to accurately compare liquid coatings to determine the best value per dollar.

Every varnish or paint carries in it an amount of solvent or thinner which when exposed to the atmosphere evaporates and is therefore termed the "volatile content." The portion which remains and which is really useful in covering a surface is termed the "base" or "non-volatile." Some liquid coatings contain a very large percentage of non-volatile; others contain a lesser percentage. Assuming that the physical and other characteristics of two such materials are absolutely identical, a difference in price from competitive sources may possibly be explained by the fact that one is high in volatile and the other low in volatile. The purchasing specification should specify the amount of non-volatile desired so that each manufacturer should quote upon the same amount of useful material per gallon. Then it is advisable for the purchaser to conduct in his laboratory tests to assure his receiving the type of material agreed upon.

The percentage of non-volatile content can be given either by weight or volume. These two figures will differ considerably hence it is necessary to specify which basis the purchaser has adopted.

The following test is an easy one for any chemist to make and has the advantage over other tests that have been proposed in that the solvent is preserved for further examination.

The apparatus necessary, as well as its general arrangement, is shown in the sketch. The flask is of the regular Engler type of distillation flask 200 cc capacity. The wire gauze below the flask is provided with an asbestos center about 3" in diameter. The heating medium is a Bunsen burner or preferably a Fisher burner as it will give more heat. The condenser is the regular type of water condenser and the side tube of the flask should extend into it to a point where the water comes in contact with the inner tube. At the lower end of the condenser, a tared and graduated 100 cc cylinder to receive the distillate, is placed.

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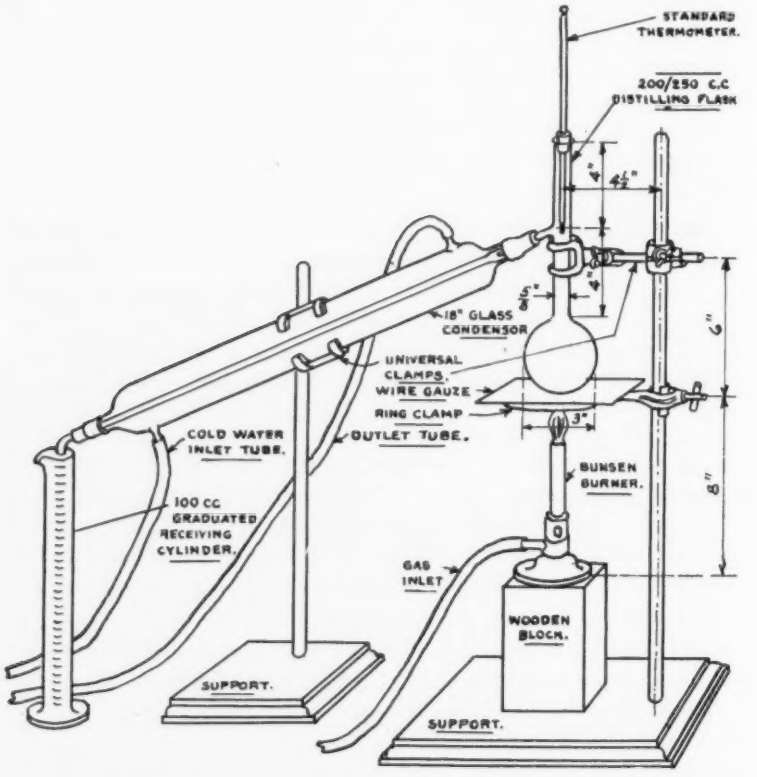
*This is the fourth of a series of articles by H. L. Hazeltine, Engineer of Insulation for The Sterling Varnish Company, Haysville (suburb of Pittsburgh) Penna.

The thermometer, meeting ASTM standards, is fitted in the cork of the flask so that it will be in the middle of the neck and so that the end of the bulb is on a level with the bottom of the vapor outlet tube. When thus placed it records the temperature of the vapor as it passes into the condenser.



One hundred cubic centimeters of the material to be tested is poured into the flask which has previously been weighed. The weight of the varnish may be calculated from the specific gravity. Place the flask in position on the wire gauze, light the burner and so regulate the flame that it is about 1½" long and just touches the gauze. As soon as the first drop falls into the receiving cylinder, note the temperature and then again so regulate the flame that the distillation goes on at the rate of between 4 and 5cc per minute (this will make about 2 drops per second). The receiving cylinder, as soon as the first drop has fallen, should be so moved that the distillate will flow down its side. Read the quantity in the receiver when the first 10°C. point is reached and for every 10° thereafter. For example if the first drop falls at 64°C. the next reading should be made at 70°C., the next at 80 and so on.

Continue the distillation until all the solvent has been driven off. This will be indicated by one of two signs; first the foaming up of the residual varnish base, second the presence of acrolein vapor in the condensate. As a rule, it will be found that the end of distillation is below 250°C. It is not wise to go far beyond this point on account of the danger of destructive distillation of the base.

Weigh the solvent in the receiving cylinder and add 2% to allow for the solvent lost or held in the base. The ratio of this weight to the weight of the varnish multiplied by 100 will give the percentage of solvent by weight. By deducting this from 100, the percentage by weight of the base can be determined.

Weigh the flask and residual base after completion of distillation. The loss in weight is the weight of the solvent which will serve as a check upon the results of the experiment as it can be verified by the weight of the distillate. The specific gravity of the solvent as determined by the hydrometer may be checked by dividing the weight of the solvent by the volume shown. The volume and specific gravity of the base can then be calculated.

The solvent should then be re-distilled in order to obtain its real characteristics after obtaining from a second and check distillation of the varnish the 100 cc necessary for this purpose. The same apparatus is used for determining the distillation characteristics of the solvent, the only difference being that the end point is taken when a puff of white vapor appears in the bottom of the flask.

NEW INSTRUMENT INFORMATION FORM

INSTRUMENTS—*Industrial and Scientific*
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Please furnish additional information on the following checked items:

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- ☐ Portable Instruments
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- ☐ Arc Welding Plays Important Role in 1929 Lightning Studies
- ☐ New Apparatus for Softening Point Determinations
- ☐ The Model 36 Federal Roundness Gauge
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- ☐ The Groundometer
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INSTRUMENTS BOOK SHELF

The books reviewed in this section can be supplied by Instruments Book Shelf, Instruments Publishing Company, Pittsburgh, Pa.

HANDBUCH DER PRAKTISCHEN OPTIK. *Bernard Halle.* Verlag von Max Harrwitz, Berlin. 136 pages. Price 4.50 mks.

REVIEWED BY RICHARD RIMBACH

The book explains methods of grinding and polishing optical surfaces, of testing the accuracy of the curves and flats, of the edging and centering of lenses and of various practical aspects of manufacture. There are sections on achromatic objectives, both doublets and more complicated forms, with useful information on the cements to be used. The latter sections of the book deal with the more commonly used natural crystals, spar, quartz, tourmaline, rock-salt, etc., with instructions and advice on the methods of cutting and polishing them for polarization purposes.

WIDERSTANDSMESSUNGEN AN UMSTROMTEN ZYLINDERN VON KREIS— UND BRUCKENPFEILERQUERSCHNITT. *F. Eisner.* Julius Springer, Berlin, 1929. Paper, 8 x 11 in. $3.00.

A report of the Preussischen Versuchsanstalt für Wasserbau und Schiffbau. This is an experimental contribution to the question of the resistance to motion of solids in liquids. It is the first part of an extensive, systematic investigation of the resistance of structures resembling bridge piers in open channels, and of the effect of various shapes upon their resistance. Part one shows the distribution of pressure and the amount of resistance in the case of cylindrical bodies. Part two reviews the present status of hydrodynamics concerning resistance and the formulas proposed for computing it. Part three gives the results of experiments with bodies similar in cross-section to bridge piers.

LES COMPTEURS D'ELECTRICITE. *R. M. Fichter.* Second Edition. Dunod, Paris, 1929. Paper, 7 x 10 in., 372 pp. $15.00.

REVIEWED BY MAX HARTENHEIM

A revised and rewritten edition of a work, first published in 1919. The treatment is descriptive. Chapters are devoted to the various types of meters; to questions of installation, calibration, and testing; to methods of charging for current, to the organization of meter service, and to frauds.

GRUNDLAGEN UND GERAETE TECHNISCHER LAENGENMESSUNGEN. *G. Berndt.* Julius Springer, Berlin, 1929. Second Edition. 7 x 10 in., Cloth, 374 pp. $12.00.

REVIEWED BY RICHARD RIMBACH

This book surveys the scientific principles of measurement and the instruments for practical use. The evolution of the usual standards is described, and the methods by which shop and control standards of length are made and calibrations are discussed. Consideration is also given to the various types of gages and other measuring instruments used in industry, to their applications and accuracy. Physiological errors in measurement and the reference of the meter to the wave-length of light are discussed in appendixes.

ZUGFESTIGKEIT UND HAERTE BEI METALLEN. *Otto Schwarz.* V. D. I. Verlag, Berlin, 1929. (Forschungsarbeiten, Heft 313) 8 x 11 in., 34 pp. 6 rm.

REVIEWED BY RICHARD RIMBACH

With the growing use of non-ferrous metals and the very general use of the Brinell test of semi-finished and finished materials, a clear understanding of the theoretical and practical connections between tensile strength and hardness becomes very important. These relations are very carefully studied in this treatise. The author first investigates the question theoretically and derives laws showing the relationship. He then describes his investigations in detail and gives the experimental results obtained with brass, nickel, aluminum, duraluminum and Skleron. Tables, based on these results, giving the factors for converting hardness to tensile strength are given. Relation of hardness to strength for copper and steel at higher temperatures and for cast metals is also shown.

PHYSICAL AND MECHANICAL PROPERTIES OF PORTLAND CEMENTS AND CONCRETES. W. *Hatt and R. E. Mills.* Bull. No. 34, Engg. Exp. Sta., Purdue University, 1928. Paper, 6 x 9, 99 pages.

This bulletin reports results of investigations of some fundamental properties of concrete that underlie the behavior of this material in structures. It is only by clear ideas of such fundamental properties as expansion and contraction under temperature and moisture, fatigue under alternately applied loads and those factors which lead to the preservation of the continuity of the surface that practice may be improved and behavior in service explained. In case of structures in service, such as stadia and concrete roads, which are continually exposed to a variable temperature and moisture, the amount of accompanying changes of length of the concrete must be predicted and provided for. The measurements of the changes of length as reported in this bulletin constitute a basis for the design of necessary expansion joints.

NEW INSTRUMENTS

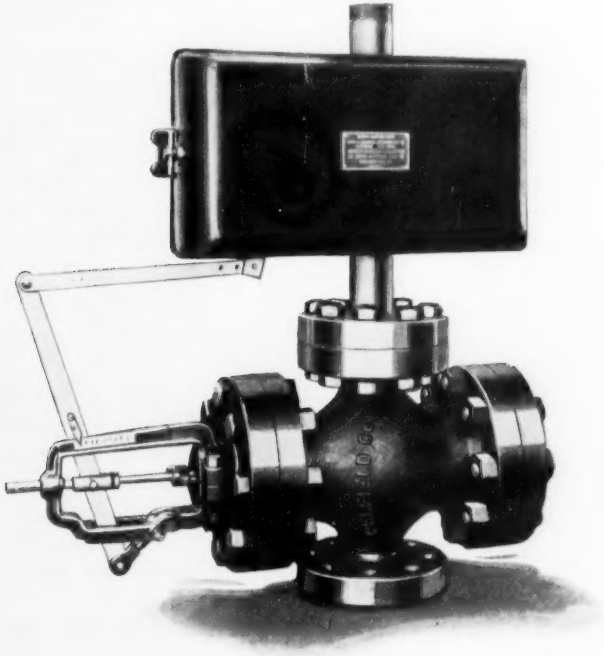
Recently Developed by Instrument Manufacturers

Write Information Section, Instruments Publishing Co., Pittsburgh, Pa., for additional information

Automatic Flow Control at 1300 lb. Pressure and 600° F.

(Brown Instrument Company)

ACCURATE measurement of flow at high temperatures and high pressures is an important part of the general problem of high pressures now commanding much attention in the field of steam plant design and in other applications as well, such as the oil refineries, the chemical plants and other industries. The automatic control of flow at these high pressures and temperatures, extremely desirable in many applications, adds further complications to the manufacture of flow metering equipment destined to cope with high pressure conditions.



Among the notably successful installations of this character dealing with high pressures are several made by The Brown Instrument Company. In these installations the Brown Forged Steel Manometer is used with the Brown Electric Flow Meter, operating on the inductance bridge

principle, to govern specially constructed remote control valves. One of the latest installations of this character employs the valve shown in the above illustration.

This valve is designed to control automatically the feeding of hot oil to a petroleum cracking still and is built to operate at 1300 lb. pressure and 600° F. temperature. This valve in the still feeder line is controlled by the setting of a Brown Automatic Control Flow Recorder located on the instrument panel of the control house, which may be any distance from the still.

This installation is typical of many applications to the control of steam, water, process liquors, gases, etc.

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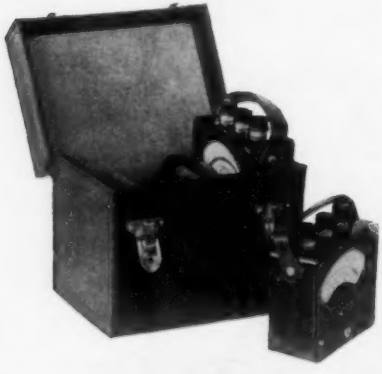
Portable Instruments

(*Westinghouse Electric & Manufacturing Co.*)

TYPE PX-4, portable d.c. instruments may now be obtained in sets of three, contained in handy leather carrying cases.

The meters operate on the D'Arsonval principle and are designed for general testing purposes where medium-sized, light-weight instruments may be advantageously used. Each meter is enclosed in a molded Micarta case 4½ inches by 4½ inches by 2 inches. The Micarta cases provide ample protection against shock, acid, moisture, or other deletorious agents.



Each meter occupies a separate compartment in its leather carrying case. Despite its three compartments, each carrying case is compactly designed, its overall size being only 6½ inches wide by 8¾ inches long by 7¼ inches deep. Plush is used for lining the interior of the case and the exterior is given a black polish. A leather handle makes the cases easy to carry, and fastening clasps keep it securely closed.

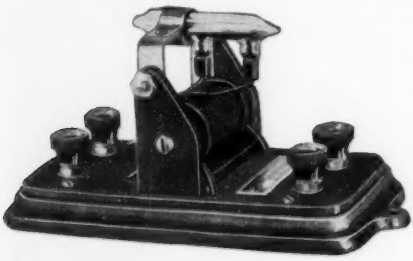
The complete outfit is of great benefit to the tester or maintenance man. The meters will give accurate, dependable service, while the leather cases provide a convenient, safe means of carrying and storing the instruments.

New Constant Temperature Equipment

THE American Instrument Company has brought out two new instruments which, when used in conjunction with each other, afford a ready solution to the problem of constant temperature control.

The first instrument is termed the Metastatic Thermo-regulator. It is essentially an accurate thermometer having sealed into its capillary two platinum wires. Mercury rising in the capillary closes the circuit through these wires and causes an opening of the heater circuit through a suitable relay. Although the whole instrument is sealed from the atmosphere and has the sensitivity of a thermometer it is adjustable so that contact can be made at any predetermined temperature. In this respect it resembles a Beckman thermometer and is adjustable with equal facility. The mercury used in this device is of the highest possible purity and the whole chamber is filled with an inert gas to prevent sparking. As the current through the regulator contacts must of necessity be small to insure sensitivity it is necessary that a relay be used with this regulator if any appreciable amount of current is to be turned on or off.

The mercury relay designed to be operated by this regulator will interrupt a current of 10 amperes at 110 volts or equivalent watts. It is of the tilting mercury tube type in which the tube is mounted in a saddle. The saddle is carefully balanced so that a minimum of energy is required to tilt it. It falls into the "circuit closed" position by gravity and an expenditure of about one-half watt of electrical energy is sufficient to tilt it and open the circuit. This arrangement of the tube can be reversed if so desired. A life test of the mercury tube indicates a probable life of several hundred thousand contacts. Replacement of the tube is a simple and inexpensive operation.



The relay will operate from a single dry cell or the secondary of a bell ringing transformer.

Some uses of the relay are as follows:

In places where an open arc would be dangerous.

As a remote control switch.

In connection with constant temperature baths, rooms and ovens for the cultivation of bacteria, or growth of plants and animals under controlled conditions.

In electrical laboratories for a multiplicity of switching purposes.

To operate alarms of all kinds.

For sign flashing.

To prevent the discharge of a charging battery if the charging current is accidentally turned off.

To turn off pump motors when the desired liquid level is reached for oil burners, and in general where an inexpensive, positive, safe, quiet relay is needed.

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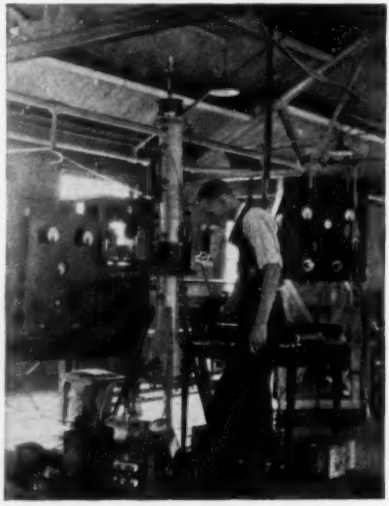
Arc Welding Plays Important Role in 1929 Lightning Studies

(Westinghouse Electric & Mfg. Co.)

ALTHOUGH many diverse applications have been found for arc welding, the tall, slender device shown in the figure is perhaps the first scientific instrument in which the welding process has played an important part. This instrument is an improved type of Norinder-Du Four cathode-ray oscillograph being used by the Westinghouse Engineers in an extensive campaign of lightning investigation. The oscillograph is encased in an air-tight housing made up of welded plates and tubes. All insulating bushings are made of specially prepared porcelain soldered directly to the steel shell to minimize the usual difficulties with securing of a proper vacuum.



Arc-welded oscillographs similar to the one shown in the illustration are installed in field laboratories at the following locations:

Stillwater, N. J.—Public Service Electric and Gas Co., 132 kv. line.

Charleston, W. Va.—American Gas & Electric Company, 132 kv. line.

Frankfort, Ill.—Public Service Company of Northern Illinois, 132 kv. line.

Chota, Tenn. — Aluminum Company of America, 154 kv. line.

Chilhowee, Tenn—Aluminum Company of America, 154 kv. line.

These oscillographs are capable of recording the complete story of a lightning disturbance on a transmission line in terms of millions of volts and millionths of a second. Both manufacturer and the operating companies realize that only through securing accurate data on the behavior of lightning can definite progress be made in providing adequate protection against this greatest menace to uninterrupted power.

New Apparatus for Softening Point Determinations

(*Fisher Scientific Company*)

THE increasing use of loaded greases as lubricants for machinery involving high temperatures and high pressures, has made it imperative to know definitely at what temperature a grease will soften or "flow" and begin to function as a lubricant.

In some recent work with one of these greases, it was impossible to obtain check results with any of the softening point or melting point apparatus on the market today. This particular grease, in order to function properly, required close control of its properties. Therefore the following apparatus was developed to determine its "flow point."

By "flow point," we mean that temperature at which the grease changes from a solid to a more or less plastic mass and begins to function as a lubricant.

The New Method and Apparatus. To make a determination, the grease is rolled into a thin sheet about ¼" thick. The end of a thin walled glass tube, ¼" inside diameter, is then pressed into the grease, forcing a pellet of the grease into the end of the tube. Most greases can be loaded into this "softening tube" in this manner, but with high softening point greases, the glass tube must be heated slightly before pressing into the grease. Two inches of mercury are then placed on top of the grease and the loaded tube is then mounted in the inner chamber of the apparatus along with the thermometer; both supported by means of the two-hole rubber stopper.

The jacket of the apparatus is then filled with sulphuric acid, glycerine or other bath liquid, and mounted over a gas burner or electric hot plate by means of a laboratory apparatus support. The bath thermometer is then placed in the side tubulature, projecting through a rubber stopper into the bath.

The jacket of the apparatus is novel in that the side arm facilitates thorough circulation of the heating liquid. The jacket has a small vent hole at the top.

As the entire bath is protected from the air, there is an absence of fumes even when high temperatures are employed. Glycerine can therefore be used for much longer periods of time in this apparatus than is the case when used in the ordinary melting point tubes.

The rate of applying heat can be regulated by means of the auxiliary thermometer in the jacket. One degree C. per minute has been found satisfactory, although 2 or even 3° C. per minute can be used in many cases. Where greases have been loaded with materials of high specific heat and low thermal conductivity, the rate of heat application should be slow, or a marked thermal differential will exist between the sample and the jacket and so give erroneous results.

When the flow point is reached, the grease suddenly softens, and under the weight of the mercury, the grease and mercury drop from the loaded sample tube. The temperature read on the thermometer beside the sample (in the air chamber) is taken as the "flow point" of the grease.

To prevent the molten grease from adhering to the inner tube, a small metal cup is mounted below the softening tube. After each determination, this cup can be replaced by a clean one and the apparatus is ready for a new test.

Other Uses of the Apparatus. While this apparatus has been designed especially for use with loaded greases, it has worked very satisfactorily as a softening point and melting point apparatus. Pitches, vaselines and similar materials have given results capable of being checked very closely. For the determination of melting points of organic compounds, the glass sample tube has been replaced by the customary narrow bore melting point tube, with very good results.

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Books on Instruments and Devices for Measurement, Inspection and Control

NOTE:—Instruments' Book Shelf is prepared to supply any book or periodical.

MICROSCOPY AND OPTICS

THE MICROSCOPE: Its Design, Construction and Application. F. S. Spiers. 1920. Cloth, 260 pages, $8.00.

THE MICROSCOPE. A SIMPLE HANDBOOK. Conrad Beck. 1923. Cloth, 144 pages, $1.25.

THE MICROSCOPE. AN ADVANCED HANDBOOK. Conrad Beck. 1924. Cloth, 231 pages, $2.50.

THE MICROSCOPIC ANALYSIS OF METALS. F. Osmond and J. Stead. 1924. Cloth, 313 pages, $5.00.

MICROSCOPIC DETERMINATION OF THE ORE MINERALS. W. Davy and C. Farnham. 1920. Cloth, 154 pages, $2.50.

TEXTILE MICROSCOPY. L. G. Lawrie. 1928. Cloth, 139 pages, $7.50.

SPECTROSCOPY. E.C.C. Baly. Vol. I, 1924. Cloth, 298 pages, $5.00; Vol. II, 1927. Cloth, 398 pages, $6.00; Vol. III. 1927. Cloth, 532 pages, $7.50.

METALLOGRAPHY. Cecil H. Desch. 1922. Cloth, 452 pages, $5.00.

PHOTOMICROGRAPHS OF IRON AND STEEL. E. L. Reed. 1929. Cloth, 253 pages, $4.00.

IMPURITIES IN METALS. C. Smithells. 1928. Cloth, 157 pages, $5.00.

ELEMENTARY CHEMICAL MICROSCOPY. E. M. Chamot. 1921. Cloth, 479 pages, $4.25.

ELEMENTS OF OPTICAL MINERALOGY. N. H. & A. N. Winchell. Part I. Principles and Methods. 1922. Cloth, 216 pages, $3.50. Part II. Description of Minerals. 1927. Cloth, 424 pages, $5.50.

ELEMENTS OF OPTICS. J. Valsek. 1928. Cloth, 215 pages, $2.00.

THE TELESCOPE. Louis Bell. 1920. Cloth, 285 pages, $3.00.

EXPERIMENTAL OPTICS. Albert F. Wagner. 1929. Cloth, 203 pages, $3.25.

PHOTOMETRY

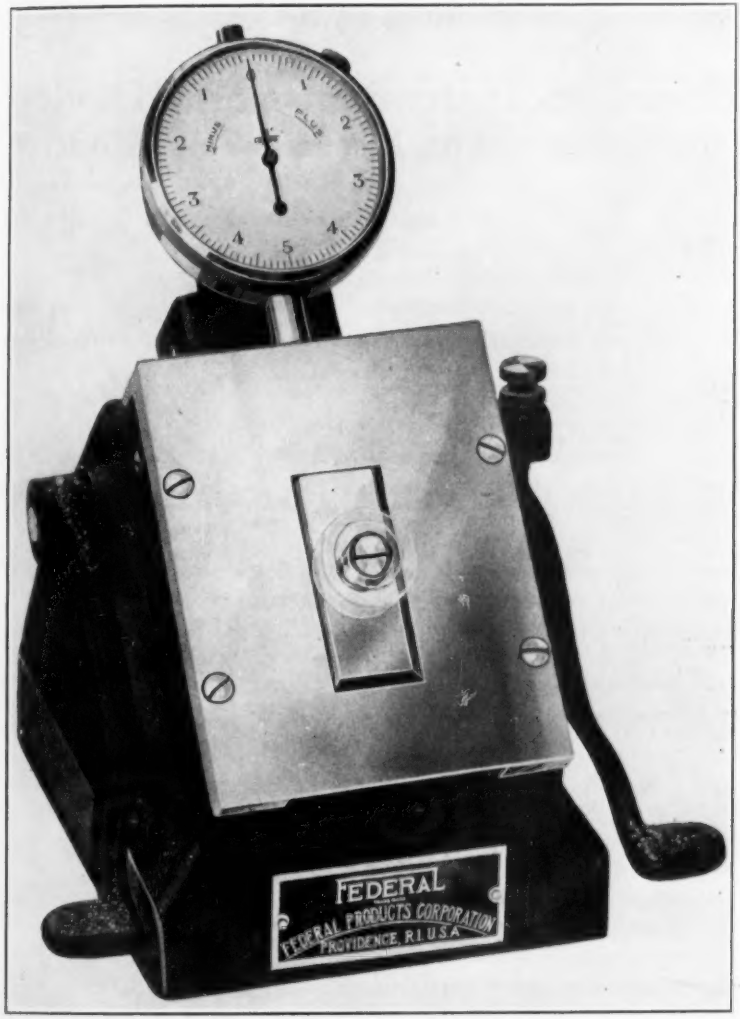
LIGHT, PHOTOMETRY AND ILLUMINATING ENGINEERING. W. Barrows, 1925. Cloth, 412 pages, $4.00.

ELECTRICAL PHOTOMETRY AND ILLUMINATION. Hermann Bohle. 1925. Cloth, 427 pages, $11.00.

The Model 36 Federal Roundness Gauge

(Federal Products Corporation)

THE gauge can be operated from either the right or left hand side and parts can be gauged as rapidly as the operator can place them on the jaws of the gauge. Indicator is graduated in .0001", is 2¾" in diameter and the graduations representing .001" are ¾" apart. Jaws are furnished in four different sizes,



3/8" to 1/2"	3/4" to 1 1/8"
1/2" to 3/4"	1 1/8" to 1 1/2"

Extra jaws can be furnished.

The gauge is very easily set to measure different sizes of holes by removing the top plate and loosening the clamping screws that clamp the lower jaw in the dovetail, place a master on the jaws or use micrometers as preferred, set jaws so that indicator registers about .001" on the minus side of "0" then tighten jaws and gauge is ready to use.

The small knurled screw on the upper part of the right hand lever is a stop to adjust the range of the indicator.

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Books on Instruments and Devices for Measurement, Inspection and Control

NOTE:—Instruments' Book Shelf is prepared to supply any book or periodical.

MISCELLANEOUS

APPLIED X-RAYS. George Clark. 1927. Cloth, 255 pages, $4.00.
PAINT TECHNOLOGY AND TESTS. H. A. Gardner. 1911. Cloth, 256 pages, 4.00.
LABORATORY GLASS BLOWING. F. Frary, C. Taylor and J. Edwards. 1928. Cloth, 116 pages, $1.50.
A TREATISE ON WEIGHING MACHINES. G. A. Owen. 1922. Cloth, 201 pages, $5.00.
POWER PLANT TESTING. J. Moyer. 1926. Cloth, 609 pages, $5.00.
SAMPLING AND TESTING OF HIGHWAY MATERIALS. W. Barton and L. Doane. 1925. Cloth, 355 pages, $3.50.
AIRPLANE PHOTOGRAPHY. Herbert Ives. 1920. Cloth, 422 pages, $4.00.
MANUAL OF PETROGRAPHIC METHODS. A. Johannsen. 1918. Cloth, 649 pages, $7.00.
TECHNICAL METHODS OF ANALYSIS. R. Griffen. 1927. Cloth, 936 pages, $7.50.
QUANTITATIVE ANALYSIS. E. Mahin. 1924. Cloth, 579 pages, $4.00.
A HANDBOOK OF SUGAR ANALYSIS. C. A. Browne. 1912. Cloth, 888 pages, $6.00.
HISTORY OF RADIO TELEGRAPHY AND TELEPHONY. G. G. Blake. 1928. Cloth, 425 pages, $7.50.
VIBRATION PROBLEMS IN ENGINEERING. S. Timoshenko. 1928. Cloth, 351 pages, $4.50.
ANALYSIS OF PAINT VEHICLES, JAPANS & VARNISHES. C. Holley. 1920. Cloth, 203 pages, $2.50.
NAVIGATION. George L. Hosmer. 1926. Cloth, 307 pages, $2.50.
THE ANALYSIS OF DYESTUFFS. A. Green. 1920. Cloth, 150 pages, $6.00.
SOME MICROCHEMICAL TESTS FOR ALKALOIDS. C. Stephenson. 1921. Cloth, 105 pages, $4.00.
THE VISCOSITY OF LIQUIDS. Emil Hatschek. 1928. Cloth, 239 pages, $4.50.
MANUAL OF FIRE ASSAYING. C. Fulton. 1911. Cloth, 219 pages, $2.50.
PETROGRAPHIC METHODS. E. Weinschenk, translated by R. Clark. 1912. 396 pages, $3.50.
THE ANALYSIS OF MINERALS AND ORES OF THE RARER ELEMENTS. W. Schoeller and A. Powell. 1919. Cloth, 239 pages, $7.50.
DEHNUNGSMESSUNG AM LAUFENDEN RIEMEN. Georg Steinmetz. 1917. Paper, 20 pages, 50c.
FEUCHTIGKEITSMESSUNG. H. Bongards. 1926. Cloth, 322 pages, $5.00.
MESSEN UND WAEGEN. Walter Block. 1928. Cloth, 339 pages, $8.00.

HYDRAULICS

HANDBOOK OF HYDRAULICS. H. King. 1929. Cloth, 420 pages, $3.50.
HYDROLOGY. D. Mead. 1919. Cloth, 650 pages, $5.00.
STEAM GAGING. W. Liddell, 1927. Cloth, 239 pages, $3.00.
RIVER DISCHARGE. J. Hoyt & N. Grover. 1916. Cloth, 210 pages, $2.50.

ENGINE INDICATORS

MANUAL OF THE STEAM ENGINE INDICATOR. C. Peabody. 1900. Cloth, 153 pages, $1.50.
STEAM ENGINE INDICATOR. F. R. Low, 1910. Cloth, 169 pages, $2.00.

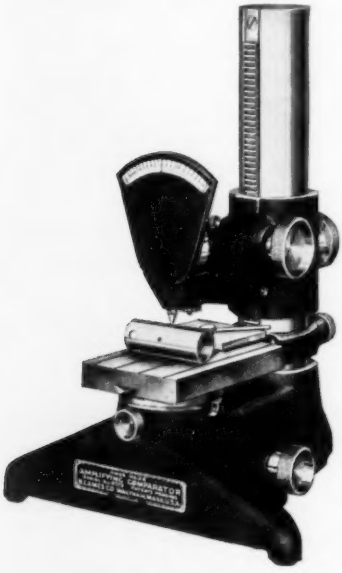
CALORIMETRY

THE EXAMINATION AND THERMAL VALUE FUEL: Gaseous, Liquid and Solid. J. Coste and E. Andrews. 1914. Cloth, 278 pages, $2.75.
THE MODERN CALORIMETER. W. P. White. 1928. Cloth, 194 pages, $4.00.

New Amplifying Comparator

(B. C. Ames Company)

THE new Ames amplifying comparator has several outstanding characteristics; one of the most important is its ability to repeat readings. Its new principle of construction eliminates horizontal stresses and strains and consequent differences in readings on the same piece of work when shifted about under the measuring point. All readings are positive and positively repeat, regardless of the direction in which the work is passed under the point.



The most delicate setting can be locked securely in place instantly and the rigid construction of the instrument prevents spring and false dial readings while the work is being tested. All readings are true readings.

The great amplication of the gauge reading is thoroughly dependable. It is obtained by the highly accurate and rugged construction of the micrometer dial gauge. The new type, fan-shaped dial records the minutest variation from zero, plus or minus. The entire range of the dial shows only 1/1000" plus and 1/1000" minus, and occupies a sweep of nearly four inches. It relieves eye strain and enables the operator to read down to the quarter ten-thousandth quickly and precisely.

The base is of cast iron, heavy, well designed to insure freedom from spring or distortion, and fitted with three rubber feet that rest steadily on uneven bench surfaces.

The column made of solid steel, 2-7/16" diameter, is bolted to base against a wide shoulder, making column and base as rigid as though one piece.

The bracket which holds indicator is of massive design, ribbed, and positively clamps to column. It is easily adjusted up and down by means of a pinion that meshes in rack on column, but cannot drop to injure the indicator when the binding clamp is loose. All adjustments are made by turning large knurled screws. Lever in bracket is accurately fitted and serves to hold the indicator contact point to absorb all strains and forces in the horizontal plane. This lever construction, for which patents have been applied, makes it possible to pass parts being measured between the contact point and platen in any direction and get absolutely the same dial reading.

The indicator is fan-shaped, graduated in 10,000ths inches, of a most simple, durable and accurate design. The dial is movable for setting zero under pointer, has ten red graduations at left of zero to indicate minus readings and ten black graduations to right of zero to indicate plus readings. Each graduation is numbered and represents .0001 inch, being approximately 3/16 inch apart.

The stop bracket consists of a casting and blade of hardened tool steel, adjustable to accommodate the work in testing position, fitted to bracket by tongue and clamped securely in place on bracket by means of binding lever.

The stops on the bracket lever protect the indicator from being jammed or injured.

The platen of tool steel is hardened, ground and lapped flat, 5″ long, 4″ wide and 1″ thick. Bottom dovetailed to receive nut for clamping in different positions to compensate for wear. Mounted on an adjustable spindle of large diameter and fitted with clamp, raised or lowered by a knurled screw on side by means of worm and gear. Special shapes and sizes of platens, and V-blocks can be supplied.

The diamond in the measuring point is rounded and will not scratch or mark the work. The pressure exerted by the point is light, just sufficient to give a positive contact.

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Books on Instruments and Devices
for Measurement, Inspection and Control

NOTE:—Instruments' Book Shelf is prepared to supply any book or periodical.

MACHINE SHOP

GAGES AND GAGING SYSTEMS. J. Woodworth. 1908. Cloth, 249 pages, $2.00.
TOOL ENGINEERING—PUNCHES, DIES AND GAGES. A. Dowd and F. Curtis. 1925. Cloth, 341 pages, $3.50.
MODERN GAGING PRACTICE. A. Dowd and F. Curtis. 1925. Cloth, 280 pages, $3.00.

METALLURGICAL ANALYSIS

RAPID METHODS FOR THE CHEMICAL ANALYSIS OF SPECIAL STEELS, STEEL-MAKING ALLOYS & GRAPHITE. C. M. Johnson. 1920. Cloth, 552 pages, $6.00.
METALLURGICAL ANALYSIS. N. Lord and D. Demorest. 1924. Cloth, 474 pages, $4.00.
CHEMICAL AND METALLOGRAPHIC EXAMINATION OF IRON, STEEL AND BRASS. W. Hall and R. W. Williams. 1921. Cloth, 501 pages, $5.00.
TECHNICAL ANALYSIS OF STEEL AND STEEL WORKS MATERIALS. F. Sisco. 1923. Cloth, 543 pages, $5.00.
CHEMICAL ANALYSIS OF IRON. Andrew Blair. 1918. Cloth, 318 pages, $5.00.
METALLURGICAL ANALYSIS AND ASSAYING. W. McLeod and C. Walker. 1903. Cloth, 318 pages, $4.50.

AIR, FUEL AND OIL ANALYSIS

TECHNICAL GAS AND FUEL ANALYSIS. A. H. White. 1920. Cloth, 319 pages, $3.00.
THE TECHNICAL EXAMINATION OF CRUDE PETROLEUM, PETROLEUM PRODUCTS AND NATURAL GAS. W. Hamor and F. Padgett. 1920. Cloth, 591 pages, $6.00.
ANALYSIS OF FUEL, GAS, WATER AND LUBRICANTS. S. Parr, 1922. Cloth, 250 pages, $2.50.
GAS & FUEL ANALYSIS FOR ENGINEERS. Augustus H. Gill. 1917. Cloth, 140 pages, $1.75.
THE LABORATORY BOOK OF MINERAL OIL TESTING. J. Hicks. 1925. Cloth, 128 pages, $2.50.
METHODS OF AIR ANALYSIS. J. S. Haldane. 1920. Cloth, 137 pages, $3.50.
A SHORT HAND-BOOK OF OIL ANALYSIS. A. Gill. 1927. Cloth, 293 pages, $4.00.
ENGINE ROOM CHEMISTRY. A. Gill. 1923. Cloth, 174 pages, $2.00.

New Manometer is Combined Flow-Meter and Pressure Indicator

AN interesting modification of the regular U-tube manometer, now being placed on the market by the Meriam Company permits the instrument to be used as either flow meter or as a pressure indicator. The illustration shows the new instrument as applied to a differential control system for gas and steam pressure, as used in a gas-heated steam heater, but it is obvious that there are many other types of equipment to which it can be applied.

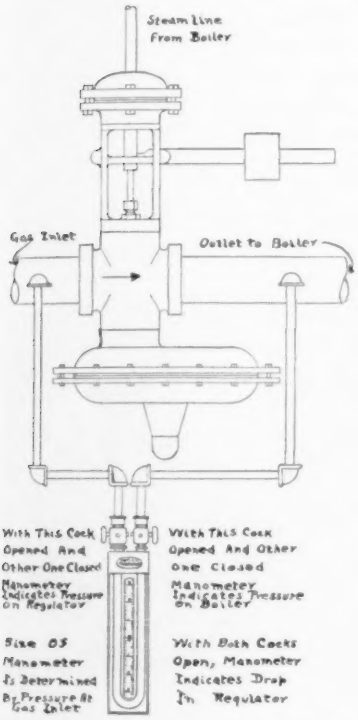
Steam Line From Boiler
Gas Inlet
Outlet to Boiler
With This Cock Opened And Other One Closed Manometer Indicates Pressure on Regulator
With This Cock Opened And Other One Closed Manometer Indicates Pressure on Boiler
Size Of Manometer Is Determined By Pressure At Gas Inlet
With Both Cocks Open, Manometer Indicates Drop In Regulator

Diagram showing new combination pressure and flow reading manometer operating on a gas and steam differential system. Manufactured by the Meriam Co., Cleveland, Ohio.

The operation of the instrument depends upon the fact that all manometers operate upon the differential principle, whether rate of flow or actual pressure is indicated.

When a manometer is used to read pressure of liquids or gases, one of the arms is connected to the atmosphere and the other to the source of pressure to be measured. The difference produced in the liquid levels in the two arms shows the difference between the pressure measured and that of the atmosphere.

Each inch of difference in level indicates .036 lbs. per square inch pressure if the liquid used is water, or .491 lbs. per square inch if mercury is used. Other liquids give results proportional to their specific gravity.

When a manometer is used to indicate flow of liquids or gases, the two U-arms are connected one on each side of an alloy steel disc connected in the pipe line whose flow is to be measured. The steel disc has an orifice of known size, and this produces a definite drop of pressure for a given rate of flow. This drop is shown on the manometer, which is calibrated to read rate of flow.

Hitherto, it has been necessary to use two manometers when both pressure and flow readings are required, but the new instrument avoids this difficulty by a simple extra device.

In the accompanying diagram, it will be seen that with the left-hand

cock open and the right-hand one closed, the manometer is between the gas line and the open air, and therefore reads gas pressure. With the reverse arrangement of the cocks closed, the manometer is connected to show pressure across the regulator—or, if a double scale and the measuring disc be also provided, the rate of steam flow.

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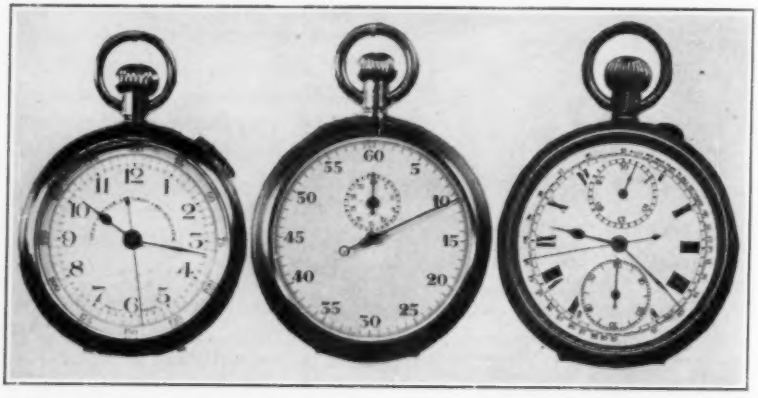
New Stop Watches

(A. Arnold & Company)

THE "Fortress" pattern, shown in left hand illustration, functions both as an ordinary time piece and also as a stop watch giving accurate readings to within a fifth of a second. It is a 30 hour watch, fitted with lever movement and is guaranteed for 12 months. In addition to the minute and hour hands a centre seconds hand is fitted, making one complete revolution per minute over a scale graduated in fifths of a second. The watch can be stopped and started by movement of a small projection on the outer rim. For ordinary everyday service this is just the sort of time piece the practical working engineer will find most useful. (This watch does not have a fly back action, but another pattern is available with that additional convenience.)

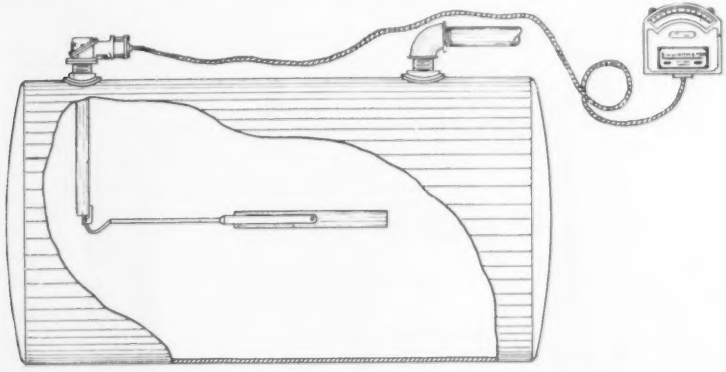


The centre illustration shows Arnold's "Racing Recorder." This is fitted with lever movement and has minute and second hands only. It has start, stop, and fly-back actions, bringing both hands back to zero, actuated by successive depressions of the winding knob in the ordinary way. This is a stop watch for general timing and testing purposes. Where the utmost exactitude of measurement is required the Split Seconds Chronograph (with independent fly-back action) illustrated in the right hand illustration is the pattern to employ. This watch has a 15 jewelled lever mechanism of the highest class. In addition to the ordinary hour and minute hands, stop watch minute, seconds, and fifth seconds hands are provided, these being started, stopped and reset to zero independently.

Distance Reading Gauge

(Liquidometer Corporation)

THE distance reading gauge operates on a principle entirely different from that used by any other gauge. It operates on a patented balanced non-pressure hydraulic system, which makes it possible to take a reading of a tank at any distance. The operation of this gauge depends primarily upon a float in the tank (See Fig. 1). This float rises and falls with the change of liquid level in the tank. By means of a float arm, fulcrum pipe and push rod this movement of the float is transmitted to the tank and mechanism of the gauge proper which is installed on the outside of the tank. This tank end mechanism is composed principally of two small flexible metal bellows. Each of these bellows in the tank end is connected by means of a separate copper tube



with two corresponding flexible metal bellows in the dial end. The bellows and tubing are filled completely with a light non-freezing oil. In the operation of the gauge the rise and fall of the float compresses one bellows and expands the other in the tank end mechanism, causing a corresponding movement of the bellows in the dial end. The movement of the dial end bellows is then transmitted by means of a rack and pinion in the senior type gauge to a pointer which indicates on a circular dial similar to a clock dial or face. In the junior models the pointer is attached to the link connecting the two dial end bellows. In the case of the recorder type the pen holder is attached to the dial end bellows.

In order that the reading of the gauge be not affected by changes in temperature as it affects the liquid in the bellows and tubing, a link arrangement is provided in the dial end which compensates automatically for any change there may be in the liquid in the gauge itself. The gauge is unaffected by changes in the gravity of the liquid as it depends upon a float in the tank.

The dials can be made up to read in any unit required such as gallons, feet and inches, pounds, etc.

New Analytical Balance

(Seederer-Kohlbusch, Inc.)

THIS new "Seko" No. 60 Analytical Balance which has just recently been placed on the market, has been designed especially to meet the requirements of Educational Institutions, but is also equally efficient for Industrial Laboratories, and all classes of Laboratory work.

The special construction of the beam arrest insures positive alignment of the agate knife-edges on their respective bearings. Releasing mechanism is the fallaway type, with three point suspension for beam, including support arms on which are arrests for the stirrups. When balance is at rest, all knife edges are free from the bearings. All agate bearings and knife-edges are of selected, highest grade agate. The agate planes are absolutely flat, and knife-edges are ground to a perfect angle. The beam is 6½ inches long, made from special hard rolled aluminum, with graduations in white on black, with fifty divisions on each side from zero. This balance with load of 100 grames is sensitive to 1/20 milligram, or 1/10 milligram with load of 200 grams.

Another improvement is the new type rider carrier, which picks up the rider from the side and carries it full length of the beam. The control on this attachment can also be set for any height rider.

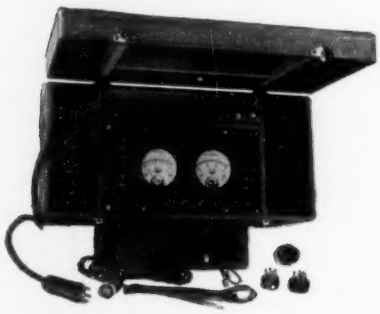
The entire balance is enclosed in a very attractive polished mahogany case, with counterpoised sliding front door, and is furnished with either slate or black plate glass base.

A Radio Set Analyzer for Testing Screen Grid Tubes

(Jewell Electrical Instrument Co.)

DUE to the great popularity of Screen Grid Receivers, Pattern 199 Radio Set Analyzer which was developed approximately a year ago, has recently been redesigned to handle this important radio development.

This portable "radio testing laboratory" makes every test required for effective radio servicing. It tests A.C., D.C., and screen grid tubes, A and B eliminators, batteries, circuits, gird plate and cathode voltages, plate milliamperes, chargers and line voltage.



The two instruments are 3¾ inch diameter. The alternating current voltmeter has four ranges to meet every need of A.C. radio testings. The 80 division silver edge scale carries a complete set of figures for every range and a knife edge pointer facilitates accurate readings.

The direct current instrument provides four voltmeter and two milliammeter scales. These ranges are adequate for service testing. The high resistance of this instrument, 1000 ohms per volt, permits the voltage reading to be made without distortion of set conditions. Figures for all ranges are shown on the scale eliminating possible errors in reading.

Binding posts provided in this service instrument make all scales of the two instruments available for independent testing.

In operation, the five prong plug or the four prong adapter is inserted into the tube socket of the radio receiver and the tube is inserted in the socket of the set analyzer. The complete electrical operation of each stage of the receiver is thus thoroughly and accurately checked on the instruments of the 199. Actual set operating conditions are duplicated as closely as possible.

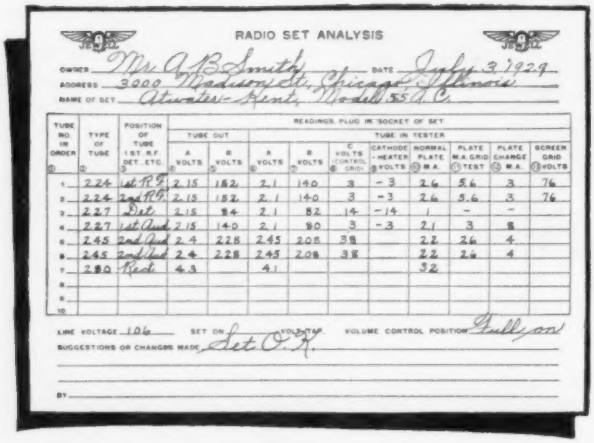
Silver contact switches of the push button type are used throughout. These switches are quick-operating and positive in action providing instant reading. The selective feature provided by the push button switches facilitates accurate and rapid work.

This set analyzer accurately checks all tubes. A small removable C battery is supplied with it, and the analyzer is so wired that when the grid test is made this battery is placed in series with the grid circuit and serves to shift the grid button 4.5 volts positive, causing a very definite change in the plate current.

A chart is furnished with the instructions giving values to be expected for all types of tubes in making this test.

The C battery is also used for the continuity test by connecting it in series with one of the instruments. Test leads are provided for this kind of work and open circuits or shorted condensers are easily located without additional apparatus.

A unique feature is the chart method of set analysis. Three items are necessary in this method of testing: The Set Analyzer, Analysis Charts and Booklet entitled "Instructions for Servicing Radio Receivers. The chart consists of blanks arranged for conveniently recording test data. It leads the servicemen through a series of tests and when completed serves as a permanent, accurate record, a copy of which may be left with the customer if desired.



RADIO SET ANALYSIS

OWNER Mr. A. B. Smith DATE July 3 1929

ADDRESS 3000 Madison St. Chicago Illinois

NAME OF SET Atwater-Kent Model 55 A.C.

TUBE NO. IN ORDER ①	TYPE OF TUBE ②	POSITION OF TUBE 1ST R.F. DET. ETC. ③	READINGS, PLUG IN SOCKET OF SET									
			TUBE OUT					TUBE IN TESTER				
			A VOLTS ④	B VOLTS ⑤	A VOLTS ⑥	B VOLTS ⑦	C VOLTS (CONTROL GRID) ⑧	CATHODE - HEATER VOLTS ⑨	NORMAL PLATE M.A. ⑩	PLATE M.A. GRID ⑪ TEST	PLATE CHANGE ⑫ M.A.	SCREEN GRID ⑬ VOLTS
1	224	1st R.F.	2.15	182	2.1	140	3	-3	2.6	5.6	3	76
2	224	2nd R.F.	2.15	182	2.1	140	3	-3	2.6	5.6	3	76
3	227	Det.	2.15	84	2.1	82	14	-14	1	-	-	
4	227	1st Aud.	2.15	140	2.1	90	3	-3	2.1	3	8	
5	245	2nd Aud.	2.4	228	245	208	38		22	26	4	
6	245	2nd Aud.	2.4	228	245	208	38		22	26	4	
7	280	Rect.	4.3		41				32			
8												
9												
10												

LINE VOLTAGE 106 SET ON VOLTAGE VOLUME CONTROL POSITION Full on

SUGGESTIONS OR CHANGES MADE Set O.K.

BY

"Instructions for Servicing Radio Receivers" contains data covering receivers of leading manufacturers. Data in the instruction book is arranged in exactly the same order as on the set analysis chart so that it is easy to check the test against the data supplied. A pad of set analyzer charts and the instruction booklet are both supplied in connection with the set analyzer.

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A Radio Set Analyzer That Provides Simultaneous Readings

(Jewell Electrical Instrument Co.)

THE dreams of radio servicemen are realized in the new Jewell Pattern 409 Set Analyzer which indicates plate voltage and current, filament, and grid voltage simultaneously.

Two of the four 3½ inch face instruments read plate voltage and current continuously. Pressing the A.C. and grid voltmeter buttons gives the remaining values of the stage under test for instant comparison and analysis. The instruments of this set analyzer are all high grade instruments in cases of moulded bakelite.

The three direct current instruments are as follows: A voltmeter for reading plate voltages with scale ranges of 0-120-300-600; a milliammeter for reading plate current with ranges of 0-12-50-300; and a voltmeter for grid filament and cathode voltages with scales of 0-10-100. Resistances of 1000 ohms per volt in the direct current instruments avoid distortion of set conditions when voltage readings are taken.

The alternating current voltmeter has a range of 0-4-18-16-160-800, the last reading being particularly suitable for checking A.C. high voltage transformer outputs.

The instruments are mounted on a bakelite panel in a portable plywood case. The case is covered with high grade black leather grain material which combines a handsome finish with outstanding wearing quality. For connecting the instrument to the set a five foot extension cord and five prong plug are provided. Four prong adapters are furnished for use in testing four prong tubes. In making the test the plug is inserted in the socket of the radio receiver and the tube is inserted in the set analyzer socket. In this way actual operating conditions are maintained and the four important values for radio testing are indicated simultaneously on the four instruments when correct buttons are pushed.

Silver contact type push button switches are incorporated in this new instrument and make it possible to select any particular scale desired instantly.

Binding posts are provided so that each scale of all instruments is available for independent testing. The Pattern 409 tests screen grid receivers and also tests all tubes. A 4½ volt C battery is supplied with the analyzer and the wiring is so arranged that when a grid test is made this battery is placed in series with the grid circuits and serves to shift the grid button 4.5 volt positive causing a very definite change in the plate current.

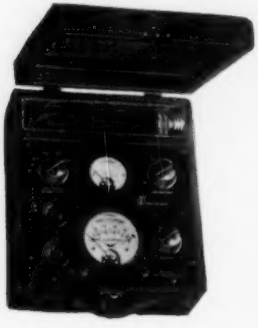
The Method of Set Analysis designed originally for use with the Pattern 199 is equally satisfactory and effective when used with this four instrument analyzer. A special Instruction and Data Book is supplied for the Pattern 409.

A Portable Direct Reading Tube Tester

(*Jewell Electrical Instrument Co.*)

MENTAL calculations which were necessary in testing radio tubes by the grid shift method are eliminated by a new tube tester known as Pattern 210.

The rectifier panel of this instrument carries an A.C. voltmeter, a direct current instrument and a transformer for supplying filament voltage of 1.1, 1.5, 2.5, 3, 5, and 7.5 volts. Sockets are provided for both four and five prong tubes. To compensate for variations in line voltage, a high resistance rheostat in connection with the A.C. voltmeter is used. This rheostat also serves as a switch and when at the off position disconnects all the apparatus. In testing a radio tube with this tube checker the correct filament voltage for the tube under test is set on a selector switch shown in the upper left hand corner of the panel. The tube is then inserted in the socket and the rheostat which compensates for line voltage fluctuations is turned until the voltmeter registers normal condition.



The potentiometer knob in the lower right hand corner is then adjusted so that the direct current instrument registers zero. The grid test button is then pressed and the net change in plate current is read directly from the instrument absolutely eliminating the reading of two values and the subtraction of one from the other. The scale of the direct current instrument is divided into 100 arbitrary units, and values of all standard tubes in accordance with this arbitrary scale are furnished in the instructions which are included with the Pattern 210 Tube Checker.

A push button switch is provided for testing rectifier tubes. When this push button is pressed the direct current instrument indicates the rectifier current on a 100 milliampere scale. Double wave rectifier tubes such as the 280 are handled by an additional push button switch which causes the rectifier current of the second plate to register on a 100 milliampere scale. Checking of the second plate of the rectifier tube is very important because failure of either plate of the double wave rectifier is liable to cause an objectionable hum.

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The Brown Instrument Company's general offices and factory will be closed for overhauling and rearrangement of equipment from August 10th to 17th. A skeleton force will be maintained for emergency. Instruments will not be shipped during this period.

The Midworth Distant Repeater

(*Evershed & Vignoles, Ltd.*)

THE Midworth Distant Repeater is an electrically operated system which enables movements as different in character as the motion of a sluice gate, lever arm, or instrument pointer, to be shown at any distance, and at any number of points: and which can also be used for the distant control of any power driven apparatus.

The system employs a transmitter actuated by the mechanical or electrical movement which it is desired to repeat, and any required number of repeating instruments, either indicating, recording, integrating or controlling. The actual transmission is of an angular motion, and normally the repeating instruments show a corresponding angular deflection. Where a movement in a straight line is to be repeated, it is therefore converted into angular motion. If, however, it is desired to repeat the original movement exactly, appropriate arrangements can be made at the repeating station.

Principle of the System. The principle underlying the system is the regulation by the originating movement (the deflections of the pointer of an instrument, the variations of level of water in a reservoir or oil in a tank, the positions of valves or switches, or any other movement), of an electrical current which passes through the controlling and repeating instruments. The regulation is such that a definite current corresponds to every stage of the originating movement, quite independently of the voltage or resistance of the circuit.

Advantages of the System. The Midworth Distant Repeater has several unique features.

(1) The operation of the system imposes no load on the apparatus of which the movements or indications are to be indicated or recorded; a valuable feature where the readings of a delicate instrument have to be transmitted to a distance.
(2) The system does not operate on the step-by-step principle, and the repeating instruments cannot get out of step with the transmitter.
(3) The system, when used for transmitting information by means of indicating or recording instruments, requires two conductors only between transmitter and repeating instruments.
(4) The apparatus automatically compensates for variations in the supply voltage and for changes in the resistance of the repeater circuit. The line connecting transmitter and repeating instruments may therefore be of any length desired, and it may vary greatly in resistance; the number of repeating instruments used may be varied at will without affecting the accuracy of the system.
(5) In the event of line breakage the apparatus returns automatically to normal working without any loss of accuracy when the break in the line between transmitter and repeating instruments is required.
(6) A large number of repeating instruments may be used without materially adding to the expense of the equipment when the apparatus is used for transmitting indications or signals. The repeating instruments are milli-ammeters, which are inexpensive.
(7) The number of applications for the system is very great, as it can be used either to transmit accurate quantitative information or for the sensitive control of apparatus situated at any distance from the transmitting station.

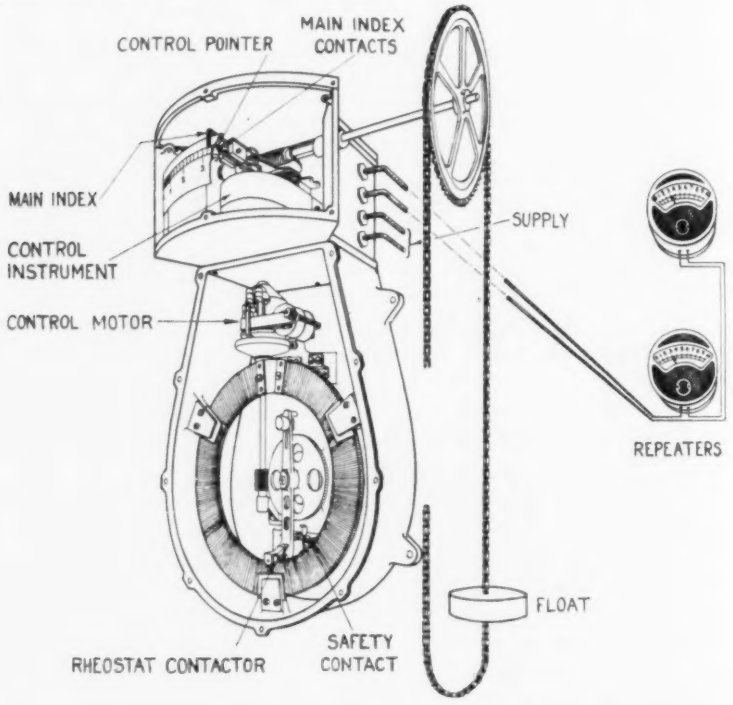
Method of Control. The transmitter shown in the illustration consists of:

(1) A main index operated by the originating movement.
(2) An electrical control instrument, contained with (1) in the upper case.
(3) The control mechanism, contained in the lower case.

The transmitter is so designed that whenever the main index is moved it carries with it the pointer of the electrical control instrument and sets in motion the control mechanism, which adjusts the current flowing in the repeater circuit to a new value corresponding to the new position of the main index.

The method of operation is as follows: Below the main index and mounted in axial alinement with it is the pointer of the electrical control instrument, which floats between two contacts borne on the main index. When the main index moves in response to the originating movement with which it is connected, one of the contacts which it carries touches the pointer of the control instrument and completes the circuit of one of two field coils of the control motor. The field coil being energized closes a switch in the armature circuit of the control motor, at the same time releasing a brake which normally prevents the armature from revolving. The armature of the control motor then turns and by means of worm gearing moves the contactor arm over the control rheostat. The direction in which the contactor arm is moved depends on which field coil has been energized—that is, on which contact has been touched by the control pointer.

As the contactor arm moves over the rheostat the current passing through the repeater circuit and control instrument is altered. This change will continue until the pointer of the control instrument reaches a position at which it floats freely between the contacts carried by the main index. Since the control pointer then no longer touches either contact of the main index, the field coil circuit is broken, the motor is switched off, and the armature is stopped instantaneously by the releasing of the brake.



The control mechanism operates, therefore, to bring the current through the control instrument to such a value that its angular deflection corresponds with that of the main index, the pointer of the control instrument and the main index being in alinement. For a given free deflection of the instrument this current must have a fixed value, so that the position of the Main Index governs the current through the controlling instrument and repeater circuit. As this current actuates both the control and repeating instruments, the pointers of the repeaters will give indications corresponding to that of the control instrument: therefore the pointers of the repeating instruments will follow wherever the main index may be moved.

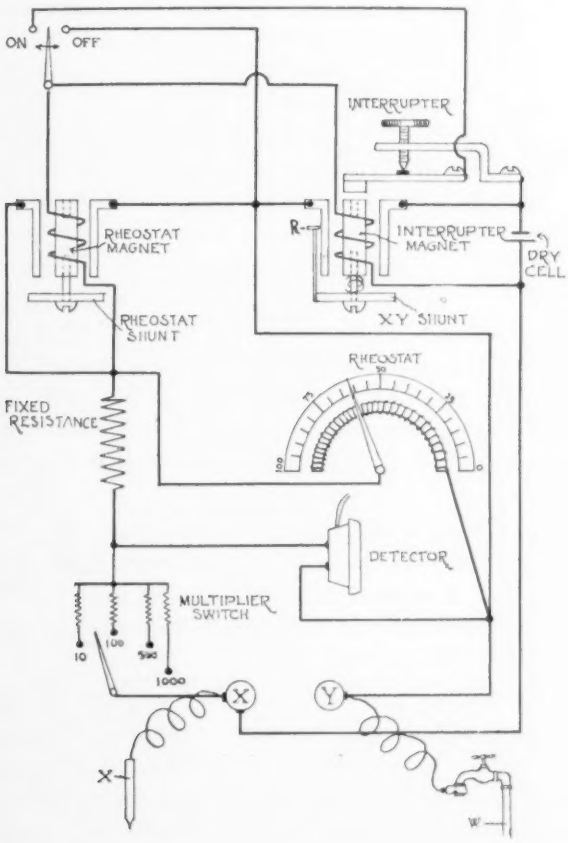
As the operation of the control mechanism tends always to bring the system to a state of balance with the pointer of the control instrument and the main index in alinement and the motor at rest, it is evident that when the state of equilibrium is attained there can be no load on the main index. Hence, as stated earlier in this description, the system can be used for repeating the indications of delicate instruments at a distance.

The Groundometer

An Instrument for Measuring the Resistance of Earth Electrodes

(Borden Electric Company)

THE Groundometer is a modified Wheatstone bridge designed particularly for measuring the resistance of earth electrodes. While the ordinary type of Wheatstone bridge is not entirely suitable for the purpose, nevertheless it has undoubtedly been used to a far greater extent than any other means for making earth measurements because the bridge, as an instrument, is less liable to derangements of any kind, errors or changes in calibration, interferences from stray fields, etc., than any moving element instrument can possibly be. Due to the danger of heating the resistance which is being measured, Wheatstone bridges are designed



to operate with currents of the order of microamperes and some interference has naturally been experienced from stray earth currents and foreign potentials on the earth electrodes.

In the testing of earth electrodes there is no danger of heating by the bridge current and it therefore becomes feasible to design the meter to operate with relatively heavy current values and in the case of the Type D groundometer, when measuring very low resistances, the current value may be as high as two-tenths of an ampere with the result that the effects from stray earth currents are greatly reduced or entirely eliminated.

The Type D groundometer has been designed for ruggedness and portability. It is put up in a sturdy oak case with leather carrying handle. The weight is but six pounds and the dimensions are 7½" x 8" x 4" overall. Having no instrument elements it is exceedingly rugged and not easily injured.

Since groundometers are used extensively for measuring the resistance of earth electrodes which are in service and connected to high potential lightening arrestors, etc., the meter is provided with automatic cut-outs which function to connect the single dry cell of battery directly across the binding posts preventing a burn out in case of a short-circuit through the meter. This provides a very low resistance shunt for the meter and one which has sufficient carrying capacity to operate the ordinary line fuses or circuit breaker.

The resistance being measured is read directly from a circular scale approximately 8 inches long divided into 100 equal parts. By means of a multiplier switch the full scale value may be made 10, 100, 500 or 1000 ohms. The meter is so arranged that the full scale value is the same as the resistance in the multiplier arm and by adding a pair of binding posts in the multiplier arm, resistances of any desired values may be connected between the binding posts, thus giving the meter a corresponding full scale reading.

To measure the resistance connected between the terminals X and Y it is only necessary to turn the knob on the ohm scale until the detector is silent, when the resistance is read directly from the scale. The meter is sensitive to approximately one-half of one division or one part in two hundred.

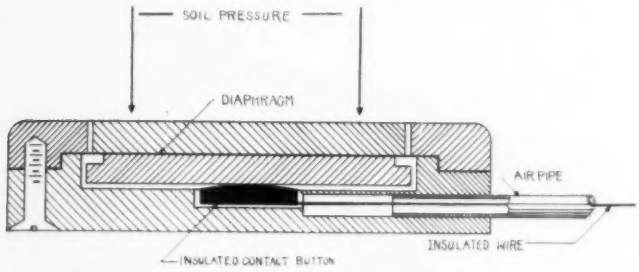
The detector is a specially designed type of telephone receiver, tested for 1,000 volts breakdown, and connected to a pair of binding posts on the face plate of the meter. When so desired for special purposes, such as routine shop testing, etc., the detector may be replaced by a galvonometer or other visual type of balance indicator.

Soil Pressure Cell

(American Instrument Company)

THE soil pressure cell consists essentially of an air-tight cylindrical brass box containing a diaphragm which is normally in contact with an insulated button. As long as pressure is exerted on the outside of the cell the diaphragm is in contact with the insulated button. If the pressure within the cell is raised until it equals the pressure on the outside of the cell, the diaphragm is in equilibrium and a very slight increase in this pressure causes the diaphragm to break contact with the insulated button. An air pipe leads to the inner chamber through which the pressure may be raised.

For determining the pressure on the soil pressure cell an indicating apparatus must be used which is mounted in a convenient position for reading and consists of a portable carrying case containing test gauges, supply tank, hand pump, batteries, electric light and other equipment necessary to make a complete outfit. With each cell is supplied a short length of 1/8" pipe and a tee with an insulated packing gland in one end.



Installing the Cell. The cells are buried as the fill progresses at points where it is desired to measure the soil pressure. Pneumatic and electrical connections are made to the conveniently located pressure indicating apparatus.

Operation. Connect the cells as shown in the diagram. Close off valve leading from tank to cell and pump up the tank to 50 to 75 lbs. pressure as shown by the tank gauge. Close the switch to cell and see that the lamp lights. Open valve No. 1 carefully and allow the pressure to rise in cell until the lamp goes out. Shut valve immediately and note this pressure which is the soil pressure on cell. Repeat with other cells.

The cells are so constructed that a moderate pressure above that of breaking contact cannot damage them. They are airtight and water proof and tested for sensitivity.

Below are references having to do with the application of the soil pressure cell:

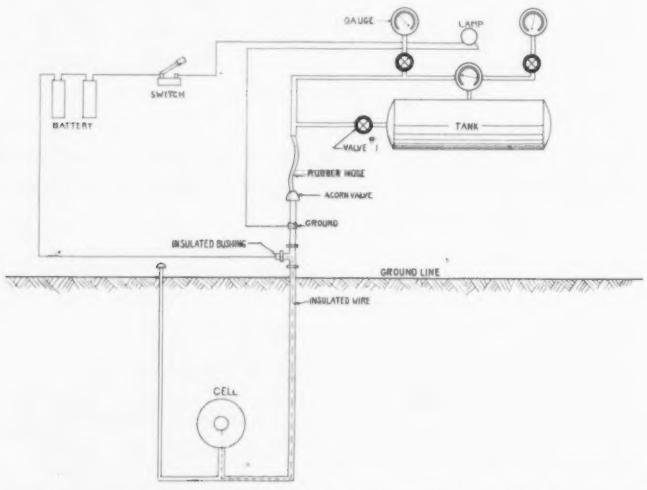
"The Distribution of Pressures Through Earth Fills," A. T. Goldbeck, Vol. XVII, 1917, Proceedings A.S.T.M.
"Public Roads," Vol. 2, No. 23, March 1920.

"Tests to Determine Pressures Due to Hydraulic Fills," A. T. Goldbeck, "Engineering News Record," April 18, 1918, page 758.

"Study of Pressures in Hydraulic Dam Cores," "Engineering News Record," December 25, 1919.

Applications:

Cores of Hydraulic Filled Dams. It is of particular value in studying the rate of consolidation or failure to solidify of fine grain clay soils of abnormal water content and thus to indicate the lateral and vertical pressure of the fill material on its retaining walls.



In such forms of construction doubt often exists as to the proper rate at which the material should be filled. If filled too slowly, uneconomical construction exists while if filled too rapidly too much pressure may be exerted, and, as has already happened in several cases, failure takes place. If the supporting ability of the walls is known, and the pressure exerted by the filling material, the work of filling may be timed to give the greatest economy consistent with safety.

Earth Pressure on Underground Structures. In the construction of tunnels, subways, culverts, foundations, etc., where the fill is of a semi-liquid, plastic or finely granular material, the pressure during or after filling may be measured.

Road Work. The cell is also valuable in measuring the pressure transmitted through road surfaces, to sub-grades.

The motion of the moving part of the instrument being only about 0.0002", the surrounding material is disturbed a minimum and for that reason future measurements can be taken and their accuracy assured.

Pressure of Concrete Against Forms. The proper design of concrete forms cannot be effected without knowing the lateral and vertical pressures of the plastic concrete against the forms. With the soil pressure cell these pressures may be determined to a high degree of accuracy.

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DECELEROMETER. Bulletin No. 210 describes the James Brake Inspection Decelerometer, an instrument for performing the method of testing brakes approved by the United States Bureau of Standards. American Instrument Co., 774 Girard St. N.W., Washington, D. C.

DISTANCE INDICATING & RECORDING OF TEMPERATURE AND HUMIDITY. Leaflet SH2844 gives information of the distance thermometer and hygrometer. Siemens & Halske A. G., Berlin-Siemensstadt, Germany. This is printed in German.

DISTANT REPEATERS. The ring tube distant repeaters are illustrated in leaflet SH 2842. This instrument can be used to transmit indications and records to any distant point. This literature is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

FLUE GAS METERS. Bulletin SH 2756 illustrates a number of applications of CO_2 and $CO + H_2$ meters. This literature is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

GAS METERS. Leaflet SH 2837 gives the applications of gas meters with electrical distant indicating and recording. This is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

GAS SERVICE JOURNAL. The June issue of the Gas Service Journal contains the following articles: High Pressure Gas Distribution; Main Line Domestic Meters; The Seemingly Impossible Task; New Gas Furnace, Developed by Gas Association Research, will Revolutionize Brass Melting. Pittsburgh Equitable Meter Co., 400 Lexington Ave., Pittsburgh, Pa.

GASOLINE METERS. Catalogue SH 2741 gives detailed information on the gasoline station meters. This is printed in German. Siemens & Halske A. G., Berlin Siemensstadt, Germany.

GENERAL INFORMATION BULLETIN. Bulletin 1A gives general information on single and double pivot portable and switchboard meters manufactured by the Rawson Electrical Instrument Company, 91 Windsor St., Cambridge, Mass.

GENERAL CATALOGUE. This general catalogue was issued March 1929, and covers the products manufactured by Adam Hilger, Ltd., 24 Rochester Place, London, N. W. 1, England.

GRAPHIC INSTRUMENTS AND NEWSPAPER PRODUCTION. Bulletin 629 illustrates the application of graphic recorders to the newspaper plant. Esterline-Angus Company, Indianapolis, Ind.

HIGH TENSION INSTRUMENT TRANSFORMERS. Leaflet SH 2859 illustrates the various types of High Tension Instrument Transformers manufactured by Siemens & Halske A. G., Berlin-Siemensstadt, Germany. This literature is printed in German.

INSTRUMENT TRANSFORMERS. Portable Instrument Transformers are described in leaflet SH 2857. This is printed in German. Siemens & Halske A. G., Berlin-Siecensstadt, Germany.

HOT WATER METERS. Hot water disc and Venturi meters are covered by leaflet SH 2850 printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

"ONE MOTION" CONTROL VISCOSIMETER. Leaflet gives information on this viscosimeter: temperature control, accuracy, convenience, testing temperature and operation. Teschner-Myers Co., Inc., 43 Warren St., New York, N. Y.

OSCILLOGRAPHS. Leaflet SH 2764 gives a number of records obtained with the oscillograph, to illustrate the wide application of this instrument. This leaflet is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

PARKS' PARABLES. The July issue of Parks' Parables discusses humidifying. Parks-Cramer Co., Fitchburg, Mass.

PENETRATION OF GREASES AND PETROLATUM. The various apparatus for testing penetration of greases and petrolatum are illustrated in Bulletin 112. American Instrument Co., 774 Girard St., N.W., Washington, D. C.

POLYMETER. Leaflet illustrates the Polymeter for making a large number of electrical measurements with a single instrument. Sensitive Research Instrument Corp., 142 East 32 St., New York, N. Y.

PRESSURE MEASUREMENTS. This 8-page leaflet illustrates the most varied applications of the McCollum-Peters Electric Telemeter for pressure measurement. Some of the applications are: The measurement of slowly varying pressures; the measurement of rapidly varying pressures including its use as an engine indicator; and as a testing machine recorder. Southwark Foundry & Mach. Co., 400 Washington Ave., Philadelphia, Pa.

PORTABLE ELECTRICAL INSTRUMENTS. Leaflet SH 2806 gives general information on instruments for use in the plant. This is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

PROPORTIONING AGGREGATES FOR CONCRETE BY WEIGHT. This leaflet discusses this important question and also illustrates the application of scales to this purpose. Portland Cement Association, Chicago, Ill.

PROTECTIVE RELAYS. A loose leaf folder contains information on a large number of protective relays. Nalder Bros. & Thompson, 97a Dalston Lane, London E. 8, England.

PYROMETERS. This booklet gives information of the thermoelectric and radiation pyrometers manufactured by W. H. Joens & Co., Duesseldorf, Germany.

QUICK WEIGHING QUADRANT BALANCE. Single sheet gives illustration and price of this instrument. Julian H. Becker, Delft, Holland.

REFLEX DRAWING APPARATUS. Sheet M4 illustrates this apparatus for drawing images seen in the microscope. C. Baker, 244 High Holborn, London, England.

SAYBOLT TYPE VISCOSIMETER. The Saybolt type universal and Furol viscosimeter tube is described in Bulletin 111 of the American Instrument Company, 774 Girard St., N.W., Washington, D. C.

SINGLE PIVOT METERS. The supplementary bulletin 103 illustrates the multimeter, wall pattern, small single pivot, semi-suspended, fluxmeter and thermo junctions. Rawson Electrical Instrument Co., Cambridge, Mass.

SINGLE AND DOUBLE PIVOT METERS. Bulletin 501 gives information and prices for d.c. single and double pivot meters. Rawson Electrical Instrument Co., Cambridge, Mass.

SIZING TESTER. The Carlson Curl Sizing Tester for determining the degree of sizing of paper is described in Bulletin 505. American Instrument Co., 774 Girard St., N.W., Washington, D. C.

STEAM METERS. Leaflet SH 2846 points out the advantages of the Siemens Steam meters. This is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

SUPER PRESSURE EQUIPMENT. Bulletin 405 covers Super-pressure Equipment for facilitating the investigation of high pressure catalytic reactions on laboratory and semi-works scale. American Instrument Co., 774 Girard St., N.W., Washington, D. C.

SURFACE PYROMETER. Leaflet SH 2854 illustrates the surface pyrometer of Siemens & Halske A. G., Berlin-Siemensstadt, Germany. This is printed in German.

SYPHON PUMP. Leaflet illustrates and gives prices on a syphon pump. Teschner-Myers Co., Inc., 43 Warren St., New York, N.Y.

TECHNICAL INSTRUMENT BULLETIN. The June, 1929, issue contains the following articles: Dark Ground Illumination in Reflected Light; Microscopical Examination of Glass; The Magnifying Spectacle; Further Notes on Field Glasses. Emil Busch Optical Co., Ltd., 37 Hatton Garden, London E.C. 1, England.

TEN YEARS OF SERVICE TO THE WORLD'S MERCHANT MARINE. This leaflet is dedicated to the installation of the first Sperry Gyro-Compass on a merchant ship, the S.S. "Bergensfjord." Sperry Gyroscope Co., Inc., Brooklyn, N. Y.

TESTER FOR COTTON FIBRE. Bulletin 1200 describes the Aminco tester for the strength of cotton fibre. American Instrument Co., 774 Girard St., N.W., Washington, D. C.

THERMO JUNCTIONS IN VACUO. Bulletin 502 gives information on thermo-junctions and the instruments for use with them. Prices are also given. Rawson Electrical Instrument Co., Cambridge, Mass.

THERMO-HYDRAULIC FEED WATER REGULATORS. Bulletin 82 describes and illustrates thermo hydraulic feed water regulators in all pressure standards up to and including 1350 pounds per square inch. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, Ohio.

TWO-IN-ONE MEGOHMER. Survey No. SI-55-GJ is a A. C. Nielsen Co. report on the 2-in-1 Megohmer used in the plant of A. M. Byers Co. H. H. Sticht & Co., 21 Park Row, New York, N. Y.

THERMOMETERS. This pamphlet of 8 pages describes refrigeration thermometers. Heath & Co., New Eltham, London, S.E. 9, England.

VENTURI METERS. Leaflet SH 2852 is on the Venturi Meter for cold water. This is printed in German. Siemens & Halske A. G., Berlin-Siemensstadt, Germany.

WATER STILLS. This 4-page leaflet gives information and prices on the water stills manufactured by the Barnstead Mfg. Co., Teschner-Myers Co., Inc., 43 Warren St., New York, N. Y.

WEATHER VEIN. Vol. 9, No. 1 of the Weather Vein contains the following articles: Comfort, Health—and Weather; Weather, Indoors and Out; Aerology and the Human Body; What is Manufactured Weather? How Does Weather Affect Health? How Does Weather Affect Comfort. Carrier Engineering Corp., Newark, N. J.

WHEN THE WHITE BULB BURNS ALONE—ALL'S WELL. Circular 101-P 6-529 illustrates the L & N signal light recorder. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

WHAT AUTOMATIC ACID CONTROL MEANS. Circular 59-G 30-129 illustrates the conductivity recording controller on mercerizing baths. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

X-RAYS IN INDUSTRY. A booklet prepared to suggest some of the industrial applications of X-rays in inspecting the internal construction of opaque materials. This booklet does not go deeply into a scientific discussion of the subject, but rather states briefly how X-rays are produced, describes the necessary apparatus, and presents some rules for the proper exposure and manipulation of radiographic films. There has been appended a bibliography of the books published on this general subject and some of the recent technical journal articles to which the reader is referred for a fuller scientific treatment. No mention is made of the diffraction method of analysis and its manifold applications. This, it is announced, will be covered in another booklet to be published. 60 pp. 5½ x 8½. Eastman Kodak Company, Rochester, N. Y.

WATER WORKS JOURNAL. The July Water Works Journal contains the following: Description of Locks 4 and 5, Allegheny River; Reconstruction of a Concrete Masonry Dam, Greenfield, Mass.; Private Water Companies of Pennsylvania to Plant Millions of Trees; Corrosion in Water Supply Systems; Water Waste. Pittsburgh Equitable Meter Company, 400 Lexington Ave., Pittsburgh, Pa.

HARDENING HIGH SPEED STEEL. Bulletin 1012 covers the Sentry Diamond Block Method of Hardening High Speed Steel. The Sentry Company, Taunton, Mass.

DILATOMETER. Bulletin No. 2904 points out that the dilatometer speeds up production in precision heat treatment. Stanley P. Rockwell Company, 66 Trumbull St., Hartford, Conn.

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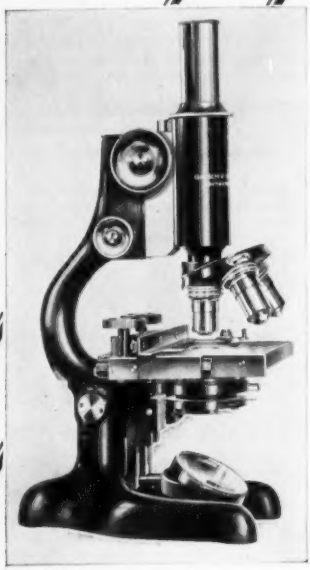

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CURRENT LITERATURE REVIEW

Abstracts on instruments and devices for measurement, inspection and control.

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The Electrical Equipment of X-Ray Apparatus. L. G. H. Sarsfield. Jl. A.I.E.E., April 1929, pp. 437-474.

The paper opens with a brief review of the equipment necessary for modern X-ray work. The details mentioned in the opening paragraphs form the subjects of the sections into which the paper is divided. These subjects include induction coils, X-ray transformers, filament-heating transformers, rectification, d.c. equipment, tests and electrical measurements, switchgear and controls, fittings, and special sets. In the induction-coil section, reference is made to two new models which have some special features. In the fairly detailed discussion of X-ray transformers an attempt is made to indicate the service required from an X-ray unit and some practical features of design calculated to provide this service. Some particulars of secondary coils and bushings are included. Some causes of breakdown of the insulation between primary and secondary windings in X-ray and filament-heating transformers are cited, and means for their removal are suggested. Valve tube and mechanical rectifiers are contrasted and some types of the latter are described. The need for adequate calibration and testing of X-ray plant is demonstrated, methods are proposed and suitable instruments are suggested. The provision of complete outfits in safe, totally enclosed containers, so desirable in the application of X-rays to works practice, is now possible, and details of some recent forms of portable gear are given.

Precautions in the Use of Standard Instruments. W. H. Lawes. Jl. A.I.E.E., April 1929, pp. 541-548.

The paper summarizes briefly the main precautions which should be adopted in the purchase, installation and use of electrical instruments which in a test department serve for calibrating instruments of a lower order of accuracy. The errors to which the potentiometer, dynamometer wattmeter, electrostatic voltmeter and moving-coil indicator are liable are considered, and means for eliminating or reducing such errors are pointed out. The author emphasizes the advantage of the method of discovering how errors may be produced, with the object of securing control of such errors. The conclusion is reached that, although preliminary investigations may be somewhat tedious, the result of due precautionary measures is increased all-round efficiency.

The Criterion for Turbulence in Curved Pipes. G. I. Taylor. Proc. Royal Soc., June 4, 1929, pp. 243-249.

Experiments are described in which colored fluid is introduced through a small hole in the side of a glass helix through which water is running. The conclusion reached by Mr. C. M. White, as a result of resistance measurements, that a higher speed of flow is necessary to maintain turbulence in a curved pipe than in a straight one, is verified directly. In a pipe bent into a helix the diameter of which was 18 times that of the cross-section, steady stream-line motion persisted up to a Reynolds number, 5830, i.e., 2.8 times Reynolds' criterion for a straight pipe. This occurred in spite of the fact that the flow was highly turbulent on entering the helix.

Analysis by X-Ray Spectroscopy. C. E. Eddy, T. H. Laby and A. H. Turner. Proc. Royal Soc., June 4, 1929, pp. 249-268.

The technique of the construction of the X-ray tube and a spectrometer in order to eliminate lines of elements not in the sample under examination, and the identification of the spectral lines, is described. In spite of these advantages, owing to lines in certain X-ray spectra obtained during the search for elements of atomic number 43, 61, 72°, 75 and 85 being wrongly identified, suspicion has fallen on the method, which we believe is unjustified, as the errors referred to can be avoided. The X-ray analysis method is found to be much more sensitive than was indicated by previous workers who showed that amounts of 0.01 per cent could be detected; we find that the spectra of elements present to three parts in a million can be readily observed. The optical method is capable of detecting as little as one part in one hundred thousand. Suitable control experiments were made to prove that the lines observed were correctly identified and came from the alloy under investigation. The X-Ray spectra of seven samples of zinc and one of manganese have been examined. One zinc sample was spectroscopically pure; the others were alloys of composition known by analysis or by synthesis. No impurities were found in the zinc, which was pure by optical spectroscopy.

The Measurement of Flame Temperatures. E. Griffiths and J. Awbery. Proc. Royal Soc., April 6, 1929, pp. 401-421.

This article discusses methods for obtaining a numerical measure of the flame temperature. The methods taken up are: insertion of solid body into flame and measuring the flame temperature; using an electrically heated wire, and spectral line reversal method.

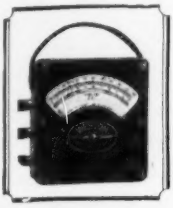
A New Integrating Photometer. W. T. Asthurg. Proc. Royal Soc., April 6, 1929, pp. 575-62.

This paper covers first the theory of the method, indicating how we are able to control the shape of the X-ray interests. The construction of the photometer and the technique of its use are discussed.

On the Ultramicrometer of Dowling. S. Ekelof. Jl. Opt. Soc., April 1929, pp. 337-341.

Describes work carried on at the Royal Institute of Technology, Stockholm.

Current Literature Review Continued on Page 18



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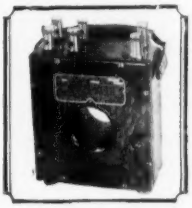

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CURRENT LITERATURE REVIEW

On Some Vacuum Recording Gauges. K. C. D. Hickman. Jl. Opt. Soc., April 1929, pp. 305-331.

Communication No. 381, Kodak Research Laboratories. A differential mercury manometer is described which covers the range 5 mm to 0.01 mm, and the principle extended to construct a moving dial instrument. The gauges are shown to yield a nearly linear deflection with pressure and their use is extended to obtain absolute measurements of pressure. A number of other devices are described.

A Modified Pirani Vacuum Gauge. T. De Vries. Jl. Opt. Soc., April 1929, pp. 333-335.

Paper briefly describes a gauge for very low pressures.

A Study of the Calcium Amalgam Electrode in Dilute Aqueous Solutions. Russell J. Fosbinder. Jl. Amer. Chem. Soc., May 1929, pp. 1345-1356.

A technique and an apparatus suitable for the determination of the activity coefficients of calcium ions have been developed.—M.E.H.

Micro-Potentiometric Determination of Reducing Carbohydrates. Joseph B. Niederl and Ralph H. Müller. Jl. Amer. Chem. Soc., May 1929, pp. 1356-1359.

Micro-Potentiometric methods for the quantitative determination of reducing carbohydrates are described.—M.E.H.

Critical Temperature Measurements on Carbon Dioxide in Small Capillaries. Harvey T. Kennedy. Jl. Amer. Chem. Soc., May 1929, pp. 1360-1366.

The critical temperature of CO_2 has been measured in glass tubes ranging from 2 to 0.004 mm. in diameter. 30.96° was taken as the most probable value. Tube size and method of illumination were studied.—M.E.H.

Capillary Tube Method for the Simultaneous Determination of Surface Tension and of Density. A. Ferguson and J. Hakes. Proc. Phys. Soc., April 15, 1929, pp. 214-223.

The pressure required to keep liquid from rising above the lower end of a capillary tube immersed in the liquid under measurement is plotted against the depth of immersion of the tube. The slope of the straight line thus obtained is a measure of the density of the liquid; and the intercept on the pressure axis, of its surface tension.—Abs. Bull. Kodak Res. Labs.

On the Penetrability of Matter by Electrons (Ueber die Elektronen-Durchlaessigkeit der Materie). E. Brueche. A.E.G. Mitteilungen, July 1929, pp. 478-483.

In the firt part of this paper is considered that part of X-ray investigation which has as its object the penetrability of matter. Starting from the opening up of this subject by Lenard, it is shown how simple rules which hold for the high electron speeds clear the way more and more for an individual condition of the single materials when going over to slower electrons. Here there occurs in part exceptional penetration, in part selective, for the particular material characteristic imperviousness. In the second part the work of the A.E.G. Research Institute in this field is briefly covered. After a description of the apparatus, several newer results are given. For the present these apply to questions of an atom chemical nature interesting to science, but investigations in this field offer important possibilities for industry.

A E G Deep Drawing Test Method (A E G Tiefzieh Pruefverfahren). G. R. Fischer. A E G Mitteilungen, July 1929, pp. 483-486.

The property of materials to be worked characterizing the drawing process is the ductility. The A E G Drawing Test Method, described in this article, reproduces the actual stresses occurring in drawing in actual practice. The apparatus developed for this purpose is suitable for laboratory and plant testing.

Use of Group Performance Tests for Evaluating Rubber Compounds That Must Withstand Repeated Compression. H. Depew and E. Snyder. Rubber Age, July 10, 1929, pp. 371-373.

Test methods for the evaluation of solid tire compounds are described in detail. They consist in preparing two test cylinders of rubber 5 inches in diameter and 3¾ inches high for each cure, and vulcanizing over a range of cures. One cylinder is tested by pounding with a force of 2,500 pounds three times per second and measuring the temperature rise. Test pieces are taken from the other cylinder and tested for abrasion resistance, tear resistance, and hardness. Accelerated aging tests are also conducted to determine the state and uniformity of cure. Data is given comparing two solid tire compounds of different sulfur contents. The conclusions, although of interest, are secondary to the evidence that rubber testing has developed to a point where the laboratory can go a long way toward evaluation compounds for service.

Quick-Response Generator Voltage Regulator—Field Tests Made with Oscillograph. E. J. Burnham, J. R. North, I. R. Dohr. Jl. A.I.E.E., June 1929, pp. 465-468.

This paper describes elaborate and severe field tests made on high-speed excitation equipment used with a 5385-kv-a. turbo generator. Complete oscillograms and curves showing the performance of this equipment are included, together with a discussion of the results obtained.

New Apparatus for Growing Crystals. A. Schubnikow. Zs. Kristallographic, Feb. 1929, pp. 516-518.

An apparatus is described which includes a constant leveling device and a unique thermostatic control for liquid baths. The regulators will operate for months without attention.—Abs. Bull. Kodak Res. Labs.

Current Literature Review Continued on Page 20

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CURRENT LITERATURE REVIEW

Standard Electrostatic Voltmeter and Wattmeter used for Measurements of Alternating Currents at Power Frequencies at the National Physical Laboratory. E. H. Rayner. Proc. Phys. Soc., Apr. 15, 1929, pp. 226-7.

Accurate instruments to be used as standards for testing commercial instruments are described.—Abs. Bull. Kodak Res. Labs.

Cloudburst Process for Hardness Testing and Hardening. Edward G. Herbert. Trans. A.S.S.T., July 1929, pp. 77-96.

It has been found that if a piece of steel be placed in a jet of hard steel balls moving at a high velocity, the balls will rebound from a hard steel surface leaving it unaffected but will roughen a soft surface. By this means the exact shape and location of soft areas may be determined, whereas by present hardness testing methods only one or a few selected spots are tested.

It has also been found that it is possible to super-harden a steel surface artificially by bombarding the surface with hard s el balls. It is believed that this process will be used to superharden the teeth of gears and other parts where extreme hardness is necessary.

Torsional Modulus of Carbon Steel, Phosphor Bronze, Brass and Monel Metal. W. P. Wood. Trans. A.S.S.T., June 1929, pp. 971-85.

The term "torsional modulus of elasticity" is defined and its general relation to the modulus of elasticity in tension and compression is discussed. A review of the published work on the determination of the torsional modulus is made and values of this constant for steel as determined by other investigators are given.

Four methods of determining the torsional modulus are available—(a) The direct method, (b) The spring deflection method, (c) The torsional pendulum method and (d) The elongation method. In the present investigation the deflection method was chosen, dead weights being used for loading and a cathetometer for measurement of deflections of springs. The modulus is calculated from this data by inverting the usual spring deflection formula.

Modulus determinations were made upon three types of steel, phosphor bronze, brass and monel metal. Variations in all the factors appearing in the usual spring deflection formula were made in order to determine whether or not they influenced the determination of the modulus. It was concluded that they have little or no influence.

Results are given in the form of averages of many tests and a grand average value for each metal studied is included.

New Applications of the Quinhydrone Electrode, Some New Indicators, and the Wulff Paper Colorimeter, to Spectrophotometry. G. Hugonin. Chim. et Ind., April 1928, pp. 732-774.

A review of the literature on the relationship between the light absorptive properties of certain indicators at different hydrogen-ion activities. Sixty-six references and a voltage-pH table for the quinhydrone electrode are given.—Abs. Bull. Kodak Res. Labs.

Derivation of Reference Values for the Calomel Electrode used in pH Determinations. D. H. Cameron. Jl. Amer. Leather Chem. Ass., Feb. 1929, pp. 80-87.

A review of the literature on electromotive cell of normal hydrogen and calomel electrodes, with derivations.—Abs. Bull. Kodak Res. Lab.

Hydrogen Ion Determination by a Modified Colorimetric Method. D. H. Cameron. Jl. Amer. Leather Chem. Ass., Feb. 1929, pp. 76-80.

A method is described which permits the colorometric determination of pH without the necessity of having prepared color standards. A definite volume of the unknown is placed in a tube and a certain indicator added. An amount of alkali is titrated into a second tube containing the same indicator dye in a buffer solution until its color matches that of the first tube. The pH may then be calculated from the ratio of alkali to the acid salt of the buffer.—Abs. Bull. Kodak Res. Labs.

Automatic Temperature Regulators. J. Cournot. Chem. et Ind., April 1928, pp. 141-147.

The various systems of temperature control for electric and gas furnaces are reviewed. Among them are found the Cambridge, Leeds & Northrup, Saurer, Arca, Verney, and the Chagnaud types. Circuits are indicated for obtaining accurate temperature regulation.—Abs. Bull. Kodak Res. Labs.

Chromium Echelette Gratings on Optical Flats for Infra-red Investigations. R. W. Wood. Phil. Mag., April 1929, pp. 742-744.

The carborundum crystal used previously by the author has been replaced by a diamond cut to the proper angle, used on gilt copper plates. A typical grating, ruled with 2060 lines to the inch, throws nearly all the light in the eighth order of mercury green light. The first spectrum in the same direction would be at 4.3 μ. Electrolytic chromium plating after ruling is possible and does not alter the light distribution. Four-inch gratings, ruled for any specified purpose, are available at $100 each.—Abs. Bull. Kodak Res. Labs.

Optical Method for Analyzing Photographs of X-Ray Tracks. L. F. Curtis. Nature, April 6, 1929, pp. 529.

The plane of the forked track is determined by projection of the negatives by the original cameras at right angles—Abs. Bull. Kodak Res. Labs.

A Logarithmic Deflection Indicator. M. Bowman Manefold and A. S. Radford. Jl. Sci. Insts., May 1929, pp. 145-151.

An indicating instrument is described which gives a deflection proportional to the logarithm of the input current over a current range of approximately 100 to 1 and a frequency range of 50 to 10,000 cycles.

(Current Literature Review Continued on Page 21)

CURRENT LITERATURE REVIEW

Determining the Quantity of Dust in Air by Impingement. F. B. Rowley and John Beal. Heating, Piping and Air Conditioning, July 1929, pp. 233-238.

The final conclusions reached by this paper were: that the amount of dust taken out of the air by the impingement method depends upon several variable factors; the determinations by such a method must necessarily be relative; the size of dust particles in air varies through a wide range, and it is evident that some minimum size must be selected below which it is not necessary to count particles; by holding the conditions constant under which the samples are taken, results may be obtained with the impingement type of counter which are reasonably consistent; there is nothing gained in accuracy by placing nozzles in series.

A Method of Measuring the Periodic Error of a Mechanism. G. A. Tomlinson. Jl. Sci. Insts., May 1929, pp. 152-153.

Instrument briefly described.

A Sensitive Micromanometer. John L. Hodgson. Jl. Sci. Insts., May 1929, pp. 153-156.

The paper describes a new type of micromanometer which, in addition to having high sensitivity, is compact and readily portable. The manometer was originally designed for work underground in connection with mine ventilation problems, for which it has proved extremely satisfactory.

A New Type High Temperature Fusion Furnace. J. B. Shaw and G. J. Bair. Jl. Amer. Ceram. Soc., July 1929, pp. 451-454.

A series of sagger mixtures is prepared with grain size varied on a calculated fineness modulus. Both dry and fired strength are related to grain size and a striking maximum point is obtained.

An X-Ray Tube with Detachable Ends and Electrodes for X-Ray Spectroscopy. W. Band and A. Maddock. Jl. Sci. Insts., May 1929, pp. 160-163.

This paper describes an X-ray tube designed so that, while retaining the advantages claimed for the tube of Dr. E. A. Owen and G. D. Preston (Journal of Scientific Instruments, October, 1926) its construction should involve the use only of a small lathe, screw-cutting being rendered unnecessary.

A New Type High Temperature Fusion Furnace. J. B. Shaw and G. J. Bair. Jl. Amer. Ceram. Soc., July 1929, pp. 447-450.

The limitations of carbon, gas, and electric furnaces for high-temperature fusion are discussed. The new oxyacetylene furnace controls the atmosphere in contact with the test cones, protects furnace parts, and insures uniform conditions throughout the furnace.

A Gravitometer for Recording Rapid Changes of Specific Gravity in Gases. A Blackie and B. Williams. Jl. Sci. Insts., May 1929, pp. 157-160.

The note describes experiments undertaken with a view to adapting a Ranarex recorder for use as a gravitometer for the measurement of small differences in the specific gravities of gases considerably lighter than air. The method employed is to utilize a standard gas of invariable composition and having a specific gravity closely similar to that of the variable gas in one side of the instrument, and the variable gas in the other. The necessary precautions to be taken and the results of the experiments are described.

Optical Methods As An Aid to the Study of Refractories. T. N. McVay. Jl. Amer. Ceram. Soc., July 1929, pp. 455-456.

The application of the petrographic microscope as an aid to the study of designating impurities in raw materials has proved successful. By the same methods fired refractories may be classified and the effects of bonds tested. Optical tests should chiefly be used to supplement and not to displace other methods of examinations.

Automatic Apparatus for the Measurement of Hydrogen-ion Concentration. A. Lassieur. Chim. et ind., November 1928, pp. 819-22.

A cycle controlled by a rotary switch is proposed for use with the ballistic galvanometer. This cycle consists simply of a charge period, a discharge period, and a period in which the galvanometer is shunted through a 7000-ohm resistance. For this particular galvanometer, the entire operation was completed in 1 minute.—Abs. Bull. Kodak Res. Labs.

Method for the Determination of the Equivalent Resistance of Air Condensers at High Frequencies. G. W. Sutton. Proc. Phys. Soc., February 1929, pp. 126-34.

The losses in the solid dielectric are measured by a resistance substitution method, and the high frequency resistance of the leads and plates by immersion in a liquid electrolyte, allowance for the resistance of which can be made.—Abs. Bull. Kodak Res. Labs.

New Method of Measuring the Electrical Resistances of Alloys. A. L. Norbury. Phil. Mag., April 1929, pp. 662-9.

The resistances of alloys may be measured by the resistance between the ball and specimen in a Brinnell hardness testing machine, provided a previous calibration is carried out, and the diameter of the impression is measured.—Abs. Bull. Kodak Res. Labs.

Determination of Particle Size by Means of X-rays. R. Brill. Zs. Kristallographie, Sept. 1928, pp. 387-403.

Particle size as determined by the Scherrer method is compared to that of v. Laue. Measurements in the presence of a strongly absorbing material have been devised from the latter method. In the Scherrer method particles must be relatively small and they must be treated with a very strong absorbing material—Abs. Bull. Kodak Res. Labs.

(Current Literature Review Continued on Page 23)

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CURRENT LITERATURE REVIEW

A New Type of Hot Cathode Oscillograph. Its Application to the Automatic Recording of Lightning and Switching Surges. R. H. George. Jl. A.I.E.E., July 1929, pp. 534-538.

This paper presents a new general purpose type of hot cathode oscillograph which employs a new electrostatic method of focusing the beam. This oscillograph will operate at any beam potential from 500 to 20,000 volts or more, and at any gas pressure below 30 microns. High photographic sensitivity at medium voltages is attained by the use of a high-intensity beam. A portable form of the oscillograph for recording lightning surges on transmission lines is described, together with circuits by means of which the lightning surge automatically starts the beam in from ½ to ¼ microseconds after the surge voltage begins to rise from zero.

Oscillographs for Recording Transient Phenomena. W. A. Morrison. Bell Jl., April 1929, pp. 368-390.

Paper presented at the A.I.E.E. Regional Meeting, March 20-22, 1929. In this paper, oscillographs developed for recording transient phenomena are described which obtain automatically records of amplitude, wave form, frequency, duration, and time of any electrical disturbance for which they are adapted. Two instruments are described for recording very short or very long transients; these may be used in combination. At power frequencies satisfactory records may be made on film or sensitized paper with a two-watt lamp. The instruments and their performance are illustrated by photographs and oscillograms.

A Braun Tube Hysteresigraph. J. B. Johnson. Bell Jl., April 1929, pp. 286-308.

In this paper apparatus for observing hysteresis loops of magnetic materials is described. It combines a cathode ray oscillograph with a vacuum tube amplifier and an electrical integrating circuit consisting of condenser and resistance. The device describes the B-H curve for alternating magnetization in the frequency range of five to perhaps several thousand periods per second. The specimens may be either long strips or closed rings. Alternating flux as low as one maxwell may be readily observed. The operation of the apparatus is analyzed so as to account for the effects of finite time constants of the amplifier and integrator, of conductance in the condensers, of demagnetization by current in the search coil and by the stray fields of coils and specimen, and of eddy currents in the specimen.

A High Precision Standard of Frequency. W. A. Morrison. Bell Jl., July 1929, pp. 493-514.

A paper presented before the Institute of Radio Engineers, April 3, 1929. A new standard of frequency is described in which three 100,000 cycle quartz crystal-controlled oscillators of very high constancy are employed. These are interchecked automatically and continuously with a precision of about one part in one hundred million. They are checked daily in terms of radio time signals by the usual method employing a clock controlled by current maintained at a submultiple of the crystal frequency. Specially shaped crystals are used which have been adjusted to have temperature coefficients less than 0.0001% per degree C.

Shielding in High-Frequency Measurements. J. G. Ferguson. Bel Jl., July 1929, pp. 560-575.

Paper presented before the A.I.E.E., June 24-28, 1929. In this paper the purpose and usefulness of shielding in high-frequency measurement are outlined. General principles of electrostatic shielding are developed as applied to simple impedances and to networks of impedances, particularly to bridge networks. Practical applications of these principles to the shielding of adjustable impedances, and in the construction of actual bridge circuits, are described. Abridgment of paper appears in Jl. A.I.E.E., July 1929, pp. 517-521.

Measurement of the Anode Circuit Impedance and Mutual Conductance of Thermionic Valves. L. Hartshorn. Proc. Phys. Soc., Feb. 1929, pp. 113-125.

Methods of applying the Wheatstone bridge to the measurement of the above quantities under operating conditions (at telephonic frequency).—Abs. Bull. Kodak Res. Labs.

Construction and Calibration of a Sensitive Form of Pirani Gauge for the Measurement of High Vacua. L. F. Stanley. Proc. Phys. Soc., April 15, 1929, pp. 194-203.

The Pirani gauge described consists of a loop of 10 cms. of platinum wire (0.001 in. in diameter) with a similar but smaller loop to balance out the fluctuating heat losses to the leads. The range of the gauge (the resistance of which is balanced against an exactly similar gauge, highly exhausted, with a Callendar-Griffiths bridge) is 2×10^{-3} mm. to 4×10^{-6} mm. of mercury.—Abs. Bull. Kodak Res. Labs.

Instrument for the Rapid and Accurate Determination of the Specific Gravity of Solid Bodies. W. A. Benton. Proc. Phys. Soc., Apr. 15, 1929, pp. 224-226.

Two indicators are set to the points of extension of a spring balance carrying the body under test, in air and in water. A simple mechanical arrangement then enables the specific gravity to be read on a suitably graduated linear scale. An accuracy to 0.005 is claimed.—Abs. Bull. Kodak Res. Labs.

The Absorption Spectrum and Decomposition of Hydrogen Peroxide by Light. H. C. Urey, L. H. Dawsey and F. O. Rice. Jl. Amer. Chem. Soc., May 1929, pp. 1371-1383.

Apparatus for this study is described. The possible photo-chemical processes with different wave lengths are discussed.—M.E.H.

(Current Literature Review Continued on Page 25)

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CURRENT LITERATURE REVIEW

Accurate Control Essential in Operation of Enameling Furnace. F. J. Watson. Fuels and Furnaces, May 1929, pp. 697-698.

The importance of the control of conditions in the enameling furnace is discussed.

Integrating Photometer. M. G. Bennett. Proc. Phys. Soc., Aug. 15, 1928, pp. 316-319.

A description of an integrating photometer designed to measure the total amount of light arriving at a point on the earth's surface, from the sun and sky, irrespective of the position of the sun or the distribution of clouds.—Abs. Bull. Kodak Res. Labs.

Manipulation of Engler Viscometers. S. Erk. Chemi-Ztg., Dec. 22, 1928, pp. 995.

The volume and temperature measurements in the use of the Engler viscometer are discussed. The efflux volume must be measured with dry calibrated flasks. During the measurement the temperature of the water bath must remain constant.—Abs. Bull. Kodak Res. Labs.

A Multiple Strand Test for Yarns. C. Schoffstall and H. Hamm. Jl. of Res., May 1929, pp. 871-885.

The essential features of the multiple-strand test method for determining stress-strain relationships of yarns are as follows: The yarn is wound from its original form of put-up onto a specimen holder under uniform tension and such holder containing the yarn is then placed in the jaws of an automatic stress strain recording tester of the inclination-balance type. The speed of the pulling jaw is recommended to be 12 inches per minute. The distance between jaws is recommended to be 4 inches. The number of strands may be varied but should be calculated to a basis of 100 strands. In cases of various sizes of the same type of yarn further simplification of results on a strength-count basis is recommended.

A New Seismometer Equipped for Electromagnetic Damping and Electromagnetic and Optical Magnification. F. Wenner. Jl. of Res., May 1929, pp. 963-999.

A procedure which may be followed in the development of a general design for a seismometer, to give approximately a specified performance, is illustrated by a concrete example. In this design the steady mass is about 500 g; the arrangement is such that the period may be determined and the damping adjusted from the recording station, which may be at a distance from the seismometer; and the magnification and its variation with the period of earth displacements, in the range from 2.5 to 60 seconds, is substantially the same as is given by a seismometer of the ordinary type having a magnification for short-period displacement of 1,250, a period of 12.5 seconds, and critical damping.

Preliminary results obtained with an experimental seismometer constructed substantially in accordance with this design are given, and a photograph of the instrument is shown.

Prism Refractometry and Certain Goniometrical Requirements for Precision. L. W. Tilton. Jl. of Res., May 1929, pp. 909-930.

To obtain an accuracy of ± 1 unit in the sixth decimal place of index by this method, angles must be measured to fractions of a second and it would seem imperative to use a fully calibrated circle. Frequently, however, correction curves are based on comparatively few of the numerous graduations on a circle and relate only to the periodic errors of low frequency. In such cases it is still necessary, therefore, to repetition on various parts of the circle in order to eliminate accidental errors and those of high frequency. On the other hand, with four or more equidistant microscopes and the proper advancing of the circle between observations, both accidental and periodic errors may be eliminated simultaneously and it becomes possible, even on uncalibrated circles of fairly high grade, to attain an accuracy approaching the order required.

Thermal Expansion of Tantalum. P. Hidnert. Jl. of Res., May 1929, pp. 887-896.

This paper gives data on the linear thermal expansion of three samples of worked and annealed tantalum over various temperature ranges between —190° and +500° C. A summary of available data by previous observers on the thermal expansion of tantalum is included.

An Application of the Interferometer to the Goniometry of Prisms. D. S. Perfect. Trans. Opt. Soc., 1928-1929, Vol. XXX, No. 3, pp. 118-125.

Method is described by means of which the goniometry of prisms may be effected with an accuracy of about 0.1 sec. The chief apparatus consists of a Hilger Interferometer No. 1, to which small additions are made, and a hollow prism, the deviation due to which may be varied by altering the pressure of the air within it. A manometer connected to the prism provides a linear scale of angles, having calculable constants, and the directional concidence of the fringe systems with a horizontal cross-wire provides the criterion by which settings are made.

Soundproofing of Airplane Cabins. V. L. Chrisler and W. F. Snyder. Jl. of Res., May 1929, pp. 897-908.

The present article contains a report of the work done in determining the structure which will give the maximum amount of sound insulation in an airplane cabin for a minimum weight.

Various small structures were tested at frequencies varying from 150 to 1, 120 cycles per second to determine the best structure available within the allowable limit of weight.

A test flight was made in a treated cabin to determine how satisfactory the structure was under operating conditions. It was found that the noise in the cabin was about the same as in a railway coach in motion.

British and Foreign Ammeters and Voltmeters. Nature, March 9, 1929, p. 391.

A synopsis of a report from the British Scientific Instrument Research Association, comparing types of permanent-magnet, moving-coil instruments made in America, Europe and Great Britain. The best known British instruments of the kind examined are stated to be quite equal to the best known corresponding instruments of foreign origin.—Abs. Bull. Kodak Res. Labs.

(Current Literature Review Continued on Page 27)

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CURRENT LITERATURE REVIEW

Interferential Collimator and Prisms. H. Nagaoka and T. Mishima. Sci. Papers Inst. Phys. Chem. Res. (Tokyo) No. 144, 1928, pp. 215-223.

The number of reflecting surfaces is reduced by making an interferometer of the collimating lens of a spectroscope. Sufficient gain in light intensity is thus obtained to examine weak sources and weak lines with relatively short exposures. A constant deviation prism can also be turned into an interferometer, serving at the same time as a spectrum analyzer without much loss of light. Spectogram plates are shown.—Abs. Bull. Kodak Res. Labs.

Probe and Radiation Measurements in the Copper Arc. W. B. Nottingham. Jl. Frank. Inst., March, 1929, pp. 299-314.

The Langmuir probe has been used to explore the copper arc. For the normal arc the cathode fall was found to be 20.5 volts—for the hissing arc 14.0 volts. Average electronic energy is from 2.1-2.7 volts. Light intensities for some lines are proportional to the square of the electron concentration and for others to the cube of the electron concentration.—Abs. Bull. Kodak Res. Labs.

Spectograph of High Light-gathering Power for the Visible Spectrum. M. Daure. Rev. d'Opt., Nov. 1928, pp. 450-456.

The author describes a spectrograph working at f/1.8. The dispersion system is composed of two 60° prisms. The article is illustrated by reproductions of plates made with the instruments. —Abs. Bull. Kodak Res. Labs.

New Machine for Measuring Displacements on Stellar Spectograms. M. Hamy. Astrophys. Jl., Dec. 1928, pp. 403-407.

Images of the spectra of the sun and a star are juxtaposed by a beam-splitting prism and may be inspected in a microscope. The line images are lengthened by vibration of the imaging objective.—Abs. Bull. Kodak Res. Labs.

Simple Method for Measuring Rotatory Dispersion. I. Bencowitz. Jl. Phys. Chem., August 1928, pp. 1163-1170.

A monochromator is improvised by placing a slit over the eyepiece of a spectroscope. The slit is so adjusted that the light is nearly monochromatic and the rotation measured by the usual crossed nicols method. An accuracy of 0.02° is claimed.—Abs. Bull. Kodak Res. Labs.

Temperature of the Oxyacetylene Flame. F. Hennin and C. Tingwaldt. Zs. Physik., May 1928, pp. 805-823.

Measurement of the temperature of the oxyacetylene flame, by the Kurlbaum method of the reversal of spectrum lines, shows that normally the hottest point (3100°C.) of the flame is about 3 mm. above the point of the luminous flame.—Abs. Bull. Kodak Res. Labs.

Measurement of Sound Absorption Coefficients. P. E. Sabine. Jl. Frank. Inst., March 1929, pp. 341-368.

Various commercial materials usable in architecture have been measured by the reverberation method. Data are given for 6 frequencies from 128 to 4096 in octave steps.—Abs. Bull. Kodak Res. Labs.

Change of Electrical Conductivity in Strong Magnetic Fields. II. Analysis and Interpretation of Experimental Results. P. Kapitza. Proc. Royal Soc., March 1929, pp. 342-372.

The departure from the linear law in low fields is caused by an internal disturbance equivalent to a magnetic field. This hypothesis permits the resolution of the resistance into two parts, an "ideal" and an "additional" resistance; the latter is independent of the temperature and is identical with residual resistance near absolute zero. It is suggested that supra-conductivity is a general phenomenon, but is observed only in certain metals in consequence of the disappearance of the "additional" resistance at low temperature. There is apparently some relationship between the atomic number of the element and the constant peculiar to the linear range of the law of change of resistance.—Abs. Bull. Kodak Res. Labs.

Automatic Level Gauge Alarm. Nature, March 16, 1929, pp. 428.

The following arrangement is used at the Billingham Works of Synthetic Ammonia and Nitrates, Ltd. The photo-electric cell or solenium cell is used to operate alarms and automatic controls regulating the level of liquid in tanks and stand pipes. A glass inspection gauge is fitted at the required level on the stand pipe, and the light- sensitive relay is illuminated through the gauge. By using opaque liquids, the light is shut off when the liquid rises and the relay then operates an alarm signal. When transparent liquids are used, an opaque float in the gauge glass may be used to shut off the illumination when the liquid rises. Alternatively, the light-sensitive relay and light source may be mounted on the same side of the glass gauge, and the relay illuminated by a beam reflected by total internal reflection at the inner surface of the glass. In this case reflection ceases when the liquid rises, the beam of light being refracted through the liquid. The latter method is convenient when flat gauge glass, to which a right angle prism can be cemented, is used.—Abs. Bull. Kodak Res. Labs.

Microscopic Examination of Starches and Flours. W. Garner. Ind. Chemist, March 1929, pp. 119-120.

Starch, mounted in water for discerning detail and in canada balsam for polarized light work, is examined first with a 16 mm. and later with a 4 mm. objective. Staining may be effected by means of iodine, methylene blue, or chlorazol fast red K. The chief features to be observed are: Length of granule; relation of length to breadth, shape, and markings; polarized light appearance; and the action of gelatinizing agents. A scheme for the examination of flours is given.—Abs. Bull. Kodak Res. Labs.

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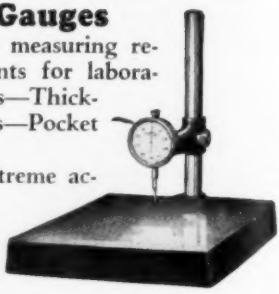

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	Page
A	
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Ames Co., B. C., Waltham, Mass.	28
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B	
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Brown Instrument Company, 4482 Wayne St., Philadelphia, Pa.	3
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C	
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E	
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F	
Federal Products Corp., Providence, R. I.	19
L	
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S	
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Stylograph Co., Coldwater, Rochester, N. Y.	29
T	
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Teschner-Myers Co., Inc., 43 Warren St., New York, N. Y.	5
W	
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SAVING GASOLINE BY ACCURATE CARBURETOR ADJUSTMENT.

J. T. NICHOLS, INSTRUMENTS, Vol. 2, No. 8, pp. 265-267, 1 fig.

This article briefly discusses the requirements for complete combustion in automobile engines. Tests made by the author on taxicabs picked at random showed that the most of them could make savings of approximately 25% by proper carburetor adjustment.

An arrangement for accomplishing this is then described.

NON-VOLATILE CONTENT.

H. L. HAZELTINE, INSTRUMENTS, Vol. 2, No. 8, pp. 269-271, 1 fig.

This is the fourth of a series of articles by this author on varnish and paint tests. The terms "volatile content" and "base" are explained. A method for determining the volatile content is given and the necessary apparatus is described.

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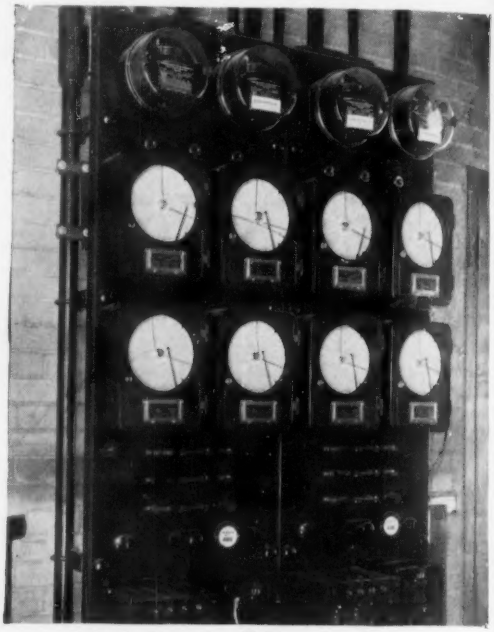

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